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The Effects of Relaxation and Laughter on the Perceived Intensity and Affect of Pain Tolerance.

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THE EFFECTS OF RELAXATION AND LAUGHTER ON THE PERCEIVED INTENSITY AND AFFECT OF PAIN TOLERANCE

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by

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This dissertation is dedicated to my beautiful wife Anne, whose love and patience guided me through the "plateau of despond" on numerous occasions. Stubborn though I am, she has shown me new ways to be strong, I can at last see the light. To my parents, Esme and John Davies, I owe a special debt of gratitude. Their unfailing love and support has been one of the few constants in my life. They will always be shining examples to me. To my sisters and brother, and all extended family members, I offer thanks for being there. Friends from today and yesteryear, I thank you for your friendship. To my teachers, especially JPK, I thank you for providing the spark of intellectual curiosity. I would like to thank those professors who were helpful when they could have been distant, especially Mike Mangum, Richard Lomax, and Gary Gintner. I appreciate the assistance of my committee, especially Dr. Amelia Lee, and thank them for coming on board at such late notice! I would like to say thank you to some of the wonderful people we laughed and cried with in Baton Rouge, in particular Craig and Ronnie (eh!), Tom ("big guy") and Kris, Cos and Franko (coffee!), Bob Wood, Ken and Laura, Mike and Sue Mangum, Patti, and Sherry (I

never would have graduated without your secretarial skills "par excellence" and warm heart). To my late furry friend "fat face", thank you for being warm and cuddly, I miss you.

I would also like to dedicate this dissertation to the memory of my dear Auntie Connie, a radiant soul.

FOREWORD

This manuscript is written in the format of the American Psychological Association. The body of the paper is presented in the format of submission for publication to scholarly journals. Additional information concerning measurement instruments and procedures, statistical procedures, tables, and literature studies reviewed for this research study are presented in the appendices.

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ABSTRACT

This study described the effect of relaxation and laughter on the perceived intensity and affect of pain induced by a cold water pressor test. Equal numbers of female athletic and non-athletic subjects (N = 36) were selected from varsity athletes and undergraduates at Louisiana State University. All subjects were pre-tested on their tolerance to a cold water pressor test. Responses on visual analogue scales for perceived pain intensity (I) and affect (A), and submersion time were recorded. The volunteer subjects were randomly assigned to one of three groups: relaxation-inducing, laughter-inducing, or control. Following a 20 minute exposure to the audio treatment tapes (laughter or relaxation), the subjects were measured again on their perceived tolerance to pain and submersion time. Subject's confidence in their level of tolerance were measured pre and post-treatment, and the expectancy of the efficacy of the treatment to increase perceived tolerance was also recorded post-treatment. Perceived pain (I and A), anxiety (STAI), confidence (CV and CS), relaxation (RE), and expctancy (EXPECT), were recorded pretest and posttest. Heart rate was monitored continuously using a photoelectric finger sensor. A multivariate mixed model (MMM) repeated measures was selected for the study. Correlational analyses were used to examine relationships between variables. Non-athletes were found to have lower perceived pain tolerance than athletes at pretest and posttest. Humor and relaxation treatments when combined significantly reduced both the perceived intensity (I) and affect (A) of pain. Follow-up ANOVAs revealed a significant time effect for anxiety (STAI), confidence (CS and CV), relaxation (RE), and heart rate (C and CH), across groups and treatments. Athletes were superior to non-athletes on perceived pain (I and A), submersion time, and confidence (CV and CS). Further research is still needed on the relationship between humor and pain tolerance.

Effects of Laughter and Relaxation on Pain Tolerance

The Effects of Relaxation and Laughter on the Perceived Intensity and Affect of Pain Tolerance

In the field of athletics, Ryan and Kovacic (1966) suggest that social learning influences pain tolerance and is responsible for gender differences. Rosillo and Fogel (1973) claim that individuals become socialized into tolerating higher levels of pain. In their study, females with low pain tolerance reported less anxiety, depression and hostility than females with high pain tolerance. The opposite findings were obtained with male subjects.

Davies and Hall (1987) found that female non-athletes perceived pain induced by a cold water pressor test to be significantly higher than their athletic counterparts in both affect and intensity. According to Elton, Stanley and Burrows (1983), pain has evolved into a very complex, multi-level, interacting explanatory system, involving neurological, biochemical, personality and psychosocial variables. Accepting that pain does not appear to be experienced in only one dimension, several researchers have suggested that the experience of pain sensations is not necessarily accompanied by affective feelings of being hurt (Beecher, 1959; Meichenbaum, 1977; Stevens & Heide, 1977). Gracely, Dubner and McGrath (1979) have demonstrated that the intensity and unpleasantness dimensions of pain can be assessed separately and can thus be affected differentially by treatments.

The findings of Davies and Hall (1987) generally supported the contention that female athletes indicate lower levels of perceived intensity and affect of pain, as compared to their non-athletic counterparts. Thus, working within the parameter of existing differences between female athletes and non-athletes in pain tolerance, this present study attempted to discover whether existing levels of pain tolerance could be affected by different cognitive-behavioral methods. Past research (Boby & Davidson, 1976; Cogan, 1978; Cogan & Kluthe, 1980; French & Tupin, 1974; Johnson, 1974) has demonstrated that relaxation is able to reduce the report of pain in clinical and laboratory settings. Recent research by Cogan, Cogan, Waltz and McCue (1987) examined the thresholds for pressure induced discomfort following exposure to four different audio tapes. In comparing laughter-inducing, relaxation-inducing, dull-narrative, and no-tape conditions, discomfort

thresholds were found to be higher for subjects in the relaxation and laughter conditions. A second experiment included the additional conditions of an interesting narrative and a multiplicatio task to discover whether laughter, and not simply distraction, reduces discomfort sensitivity. Discomfort thresholds only increased for subjects in the laughter-inducing condition.
Research (Isen, 1985; Isen, Daubman, & Nowicki, 1987; Isen & Gorgoglione, 1983) exists which attests to the impact of positive affective states on cognitive performance. Laughter has been found to be superior to relaxation and other audio distractions (Cogan et al., 1987) on pressure-induced discomfort thresholds, although there has not been any research on the impact of these techniques on perceived pain tolerance.

While research indicates that female athletes are more tolerant of pain than non-athletic females (Davies & Hall, 1987; Jarmenko, Silbert & Mann, 1981) there is speculation as to the reasons for this difference. As relaxation techniques (Jacobson, 1938) can be classified as learned skills which require a period of training in order to gain proficiency, this may explain differences in the ability of individuals to utilize this technique. Elite athletes have mastered a variety of learning strategies, which are prerequisites for skill acquisition and may have access to a more extensive schema system (Schmidt, 1975). The ability to achieve competence in relaxation may place athletic females at an advantage in tolerating cold-pressor pain.

Laughter, according to Cogan et al. (1987), is naturally occurring and effortless, and has been found to be potentially more beneficial than other behavioral techniques for reducing pain sensitivity. It is hypothesized that laughter is less likely to result in treatment differences between female athletes and non-athletes. If the efficacy differences between relaxation and laughter in tolerating pressure-induced discomfort thresholds (Cogan et al., 1987) can be generalized to the cold-pressor test and to an athletic population, we may have to revise our use of classic relaxation techniques in sport.

Research is thus needed to investigate whether differences exist between female athletes and non-athletes in their ability to utilize affective and relaxation techniques in reducing perceived pain tolerance, and which treatment is more effective.

<u>The main purposes of this study were</u>: (a) to investigate the efficacy of the two treatment conditions

and the control on the level of perceived pain tolerance (affect and intensity), (b) to assess whether there were group differences (between athletes and non-athletes) on the level of perceived pain tolerance (affect and intensity), (c) to assess whether differences existed between athletes and non-athletes on any of the pain variables, and (d) to assess the effect of time on perceived pain, anxiety, confidence, expectancy, submersion time, and heart rate.

The sub-purposes of this study were: (a) to examine the relationship between heart rate and the level of perceived pain tolerance (affect and intensity), (b) to examine the effect of the 3 treatment conditions on heart rate, (c) to investigate possible differences in heart rate between athletes and non-athletes, (d) to assess whether pretest confidence correlated with perceived level of pain tolerance (affect and intensity), and (e) to assess whether classification as a monitor or blunter had any effect on the perceived intensity and affect of pain.

Method

Subjects

Eighteen female varsity athletes (NCAA Division 1), and 18 female participants from university undergraduate activity classes, who satisfied basic exclusion criteria, were randomly selected. All the subjects were volunteers, with the activity class members receiving experimental class credit. Non-athletes were randomly selected from volunteers who completed a questionnaire which assessed their current and previous participation in physical exercise. Non-athletic subjects were only eligible if they: (a) were not currently, or had not previously, participated in any form of representative sport, (b) had not previously participated voluntarily in organized sport for more than 2 hours a week, and (c) were no currently training or participating voluntarily in a recognized sport, for more than 2 hours each week.

Subjects were instructed not to engage in strenuous physical activity the evening before testing. They were also asked to abstain from drugs, alcohol, coffee, tea, and cola during the 24 hours preceding the experiment. As a precaution against childbirth conditioning the subject to a higher level of pain tolerance than would be normally expected, any subjects with children were excluded from the study. Only 2 subjects, who were otherwise eligible, were excluded under this criteria. Any subjects not achieving a relaxation effect (determined by an examination of the sampled heart rate, or Likert scale), or failed to laugh (visual observation) at the humor tape, were excluded from the study. One subject was excluded from each group for not satisfying the above criteria.

Instruments

Cold Water Pressor Test. Pain tolerance was measured on the cold pressor test (Jarmenko et al., 1981; Worthington, 1978). Botwinick (1978) indicated that sensory response may be fairly homogeneous for 20 year olds, therefore the cold water pressor test appeared to be appropriate to facilitate the detection of any treatment effects. The eight inches of iced water was contained in a styrofoam bucket. The water was stirred continuously, and maintained at 1-2o C by the frequent addition of ice.

Visual Analogue Scale The visual analogue scale used to assess perceived pain, consists of two 150 mm straight lines lines, drawn on a piece of white paper. The first line represents sensation, with endpoints designated as "no sensation" and "the strongest sensation I can imagine." The second line represents affect, with endpoints designated as "not bad at all" and "the most intense bad feeling for me". The lines can be marked with a pencil to represent the level of intensity or affect experienced. The instructions accompanying the visual analogue lines provided information in the form of an analogy, which clarified the distinction between the affective and the intensity dimensions of pain.

Audio Tapes Three audio tapes were used during the experiment. The two treatment audio tapes were George Carlin's "stuff tape" (1981), and a modified version of progressive relaxation (Jacobson, 1938), following the protocol of Cormier and Cormier (1979). The relaxation involved 15 muscle groups, which were systematically relaxed twice. For the purposes of standardizing experimenter input, the relaxation treatment was presented in tape form.

Miller Behavioral Style Scale (MBSS). This scale, developed by Miller (1979), was administered to all the subjects prior to the start of the pre-recorded instructions. A pencil and paper test, the scale is designed to identify monitors or blunters. The scale consisted of four hypothetical stress-evoking scenes of an uncontrollable nature. Each scenario was followed by eight statements, which represented different ways of coping with the situation. The subject simply marked all the statements following each scene that were personally applicable. Blunters are individuals who distract themselves from threat-relevant information. Conversely, monitors are individuals who seek threat-relevant information.

Expectancy Measures and State Anxiety Measure (STAI). This study included a measure of subject expectancy of the efficacy of the treatment to increase tolerance to the cold water pressor test, utilizing the protocol of Stefanek and Hodes (1986). Prior to the post-treatment cold pressor test, an expectancy questionnaire was administered to all subjects. The questionnaire consisted of five items rated on a 10 point scale. The Borkovec and Nau (1972) expectancy assessment instrument was modified to emphasize the reported effectiveness of the treatments in increasing pain tolerance.

A modified version of the State Anxiety Form (Spielberger, Gorsuch, & Lushene, 1970) was also used. This self-report measure of anxiety was administered to the subjects before each exposure to the cold water pressor test. Five statements are presented on paper, each with a 7 point scale. The scale ranges from 1 (not at all) to 7 (very much so), a number being marked by the subject to represent their present feelings.

Heart Rate. In order to ascertain whether the relaxation group had achieved a more relaxed state as a result of the tape, heart rate was monitored continuously throughout the entire experiment (approxiamately 42 minutes). The monitor used was the Industrial and Biomedical Sensors Corporation automated blood pressure and pulse rate monitor (model SD-700A) which measured heart rate in beats per minute. Heart rate was recorded from the digital display using a Panasonic VHS movie camera (AG-1606), with built in timer. Kohn (1977) suggests that in young subjects, bodily systems are quicker to return to functioning following the introduction of a stimulus, so that heart rate returns to baseline more quickly. As stated previously, Botwinick (1978) also indicates that sensory functioning may be fairly homogeneous for 20 year olds. As the mean age of the subjects was around 20 years of age, heart rate appeared to be a suitable measure to detect stimulus response.

Relaxation Assessment. To assess whether a state of relaxation had been achieved through the treatments, subjects were administereda visual analogue scale pretreatment and posttreatment. The scale consisted of a 15 mm line, with endpoints designated as "zero relaxation" and "total relaxation". Subjects were required to mark the line according to how they currently felt.

Confidence Level. Each subject's confidence in their ability to keep their hand submersed in ice-water for at least 5 minutes was assessed. A brief Likert type scale and a visual analogue line were presented before each cold water pressor test. The Likert type scale consisted of 4 levels of confidence ("not at all", "somewhat confident", moderately confident", and "very confident"). The analogue line consisted of a 15 mm line on white paper, with end points designated as "0% confidence" and "100% confidence."

Procedures

Each subject was provided with a brief description of the study and then asked to sign a consent form and waiver of liability before being allowed to participate. The testing was carried out on an individual basis. In the presence of one male experimenter, the subjects were instructed to listen carefully to the taped instructions, following the directions exactly.

All the subjects had their left index finger connected to the photoelectric sensor, so that heart rate could be monitored throughout the experiement. Once a baseline rate had been assessed (approximately 12 minutes), heart rate was recorded from the digital display using the camera for the duration of the experiment (an additional 30 minutes approximately). Following completion of the experiment, heart rate levels were sampled at 20 second intervals, using the built in clock. The highest and lowest heart rate figures were recorded each 20 seconds and then averaged separately over each phase of the experiment. This provided low and high heart rate figures for baseline (BASEL and BASEH), cold pressor test one (CPL1 and CPH1), treatment (TXL and TXH), cold pressor test two (CPL2 and CPH2), and pretreatment-posttreatment (C and CH).

Following the protocol of Price, McGrath, Raffi, and Buckingham (1983, pp. 47-48), subjects were made familiar with visual analogue lines, and the difference between the intensity dimensions and affective dimensions of pain. They were asked to complete these lines to reflect their rating of the pain sensation intensity, and the affective magnitude of the experimental pain. The lines were presented at 1 minute intervals during the cold water pressor test, subjects marking the lines with a pencil held in their left hand. Subjects were reminded not to disturb their submersed hand. In order to minimize the movement of the left hand, the pencil was placed in the subject's hand and the visual analogue lines were placed under the hand.

The taped instructions then asked all subjects to complete a confidence Likert scale, and a short-form (5 items) of the State Anxiety Form (Spielberger et al., 1970). The subjects were then asked to remove jewelry and any restrictive clothing from their right arm. Subjects were seated in an upright chair, to the right of which was a styrofoam bucket containing eight inches of iced water. Comfortably seated, the subjects were directed to place their right arm into the bucket of ice water until the middle finger touched the bottom. Keeping the hand straight, this position was to be maintained until the subject could no longer tolerate the pain, or until 5 minutes had elapsed. This ceiling on submersion time was designed to minimize any danger to the subject, although the subjects were not told beforehand that a time limit had been imposed. Submersion time was measured with a hand stop-watch from the moment the hand entered the water until the hand was withdrawn.

Following withdrawal of the hand, each subject was randomly assigned to one of the treatment groups or the control group for a period of 20 minutes. To minimize the delay between treatment and post-test tolerance measurement, the treatment and control sessions were conducted adjacent to the test area. The subject was asked to listen to either the relaxation tape (seated on a reclining couch) or the laughter tape (seated in an upright chair). The control group was asked to sit quietly in an upright chair for 20 minutes. Before completing the treatment phase, subjects were asked to complete the expectancy questionnaire (Borkovec & Nau,1972).

After completion of the treatment phase, the subjects were prompted to prepare for the second cold pressor test, with the instructions again asking them to fill in the expectancy questionnaire, STAI form, and confidence scale. The subjects were asked to complete the hand immersion under the same conditions as before, completing the visual analogue scales at 1 minute intervals.

As part of the relaxation assessment, baseline heart rate figures were compared with heart rate recordings during the relaxation treatment. The comparisons paired the lowest averaged (every 20 seconds) baseline figure with the lowest averaged (every 20 seconds) relaxation figure. The criteria for achieving relaxation was a reduction in heart rate of 5 beats per minute.

Design and Analysis

The analysis involved a 3 (treatment) x 2 (groups) x 2 (trials) MANOVA, with repeated measures on the last factor. The dependent variables were the visual analogue scale scores (measured in mm) for intensity of perceived pain (VASI) and affect of perceived pain (VASA), time of submersion, heart rate measures, expectancy rating, anxiety scores, and confidence level. A multivariate mixed model (MMM) repeated measures analysis (Schultz & Gessaroli, 1987) was selected for the study. The MMM analysis is an extension of the more common univariate mixed model ANOVA, the presence of multiple dependent measures necessitates a multivariate approach. The multivariate test statistics are applied to the multiple dependent measures but not to the repeated measures, providing more power than if a multivariate treatment was used on the repeated measure and yet still providing for experimentwise control over Type 1 error rate (inflated when separate analyses are used for each dependent variable).

If the multivariate *F* was significant (using the Hotelling-Lawley Trace to provide an approximate *F* statistic), the relative contribution of each dependent variable was examined with univariate ANOVAs. Conducting multiple ANOVAs following a significant MANOVA may produce inflated Type 1 error rates, although the significant multivariate *F* does provide an overall protection. All post-hoc analyses were performed using ANOVA procedures and a .05 level of significance was set *a priori* for all effects.

Follow-up multiple comparisons were conducted using the Student Newman Keuls (SNK) procedure (Harris, 1975) to evaluate group differences and treatment differences between the pretest and posttest scores on the pain variables. The SNK procedure was also used to evaluate whether significant differences existed between the groups on pretest score and treatment groups on pretest scores.

Separate MANOVA analyses were conducted on both the single measure pain variables (MONT, BLUNT, and EXPECT), and the heart rate data. The dependent measures for heart rate were: low heart rate for pretreatment and posttreatment cold water pressor test (C), high heart rate for pretreatment and posttreatment cold water pressor test (CH), low heart rate during baseline (BASEL), high heart rate during baseline (BASEH), low heart rate during treatment (TXL), and high heart rate during treatment (TXH). Lowest and highest heart rate figures were selected every 20 seconds and then averaged over each phase of the experiment. Univariate ANOVAS examined the relative contribution of each dependent variable, and the SNK procedure evaluated whether significant differences existed between the groups or treatments pretest. SNK pairwise comparisons were also conducted between the combined treatment groups (relaxation and humor) and the control group on posttest perceived pain (I and A).

Correlational analyses were conducted to examine the relationship between the dependent variables. These analyses were performed by athletic group, treatment group, and for the entire sample.

Results

Analyses of Variance

The repeated measures multivariate analysis on the pain variables revealed a significant group effect, $F(7, 24) = 2.78$, $p < .02$, and a significant trials effect, $F(7, 24) = 6.72$, $p < .01$. The treatment by time interaction, $F(14, 46) = 2.65$, $p < .01$,and the group by treatment interaction, $F(14, 46) = 7.59$, $p < .01$, were both significant. No other effects or interactions in this analysis were significant.

Analyses on Intensity (I) and Affect of Pain (A)

Univariate ANOVAs revealed a significant group effect on the pretest posttest visual analogue for pain intensity (I), $F(1,30) = 6.89$, $p < .05$, and a significant treatment condition effect, $F(2, 30) = 3.29$, $p < .05$ follow-up Student Newman-Keuls revealed significant group differences, with the non-athletic group recording significantly higher levels on I. The SNK on treatment condition effect revealed no significant pairwise differences between groups. Subsequent contrasts between the control group and the two treatment groups combined produced significance, $F(2, 30) = 3.75$, $p < .05$, with the control group recording significantly higher levels ($M = 502.89$, sd =

184.99 and $\underline{M}$ = 362.30, sd = 171.74, respectively).

Univariate ANOVAs on the pretest posttest visual analogue for pain affect (A), revealed a significant group effect, $\underline{F}(1, 30) = 10.79$, $\underline{p} < .01$, a significant treatment condition effect, $\underline{F}(2, 30) = 3.19$, $\underline{p} < .05$, and a significant time effect, $\underline{F}(1, 30) = 6.84$, $\underline{p} < .01$. Follow-up SNK revealed significant group differences, with the non-athletic group recording significantly higher levels on A. The SNK on treatment condition effect failed to detect significant pairwise differences between groups. Subsequent contrasts between the control group and the two treatment groups combined produced significance, $\underline{F}$ (2, 30) = 3.78, $\underline{p} < .05$, with the control group recording significantly higher levels ($\underline{M}$ = 485.61, sd = 189.59 and $\underline{M}$ = 306.19, sd = 170.85,respectively). The SNK performed for the time factor indicated that higher posttest times were recorded across groups and across treatments.

The SNK performed on I and A to assess pretest differences found that there were no significant differences ($\underline{p} > .05$) between the three treatment groups. Significant group differences ($\underline{p} < .05$) were found between the pretest non-athletes andathletes, with the non-athletes recording the higher scores.

Insert Figure 1 and Tables 1 & 2 about here

Insert Figure 2 and Tables 3 & 4 about here

Univariate ANOVAs revealed a significant time effect on the pretest posttest state anxiety level (STAI), $F(1,30) = 39.89$, $p < .0001$. Follow-up SNK revealed that lower levels of anxiety were achieved on the posttest, across athleticism groups and treatment groups ($M = 15.75$, sd = 4.66 and $M = 11.14$, sd = 5.14, respectively). The SNK conducted to assess pretest differences between treatment conditions found no differences. The SNK on pretest group anxiety levels found no significant differences. Significant differences ($p < .05$) were found between the non-athletes at pretest and the non-athletes and athletes at posttest.

Analyses on Submersion Time (TM)

Univariate ANOVAs revealed a significant group effect on the pretest posttest time of submersion factor (TM), $F(1,30) = 4.99$, $p < .03$. Follow-up SNK revealed significant group differences, with the athletes recording significantly higher times than the non-athletes ($\underline{M}$ = 290.61, sd = 39.98 and $\underline{M}$ = 233.69, sd = 109.27, respectively). The SNK conducted to assess pretest differences found that athletes were significantly higher on time than non-athletes at pretest and posttest. Athletes achieved significantly higher times ($\underline{p}$ < .05) from pretest to posttest, differences for non-athletes pretest to posttest were not significant.

Analyses on Confindence (CV and CS)

Univariate ANOVAs revealed a significant group effect, $\underline{F}(1,30) = 20.22$, $\underline{p} < .0001$, and a significant time effect, $\underline{F}(1, 30) = 5.33$, $\underline{p} < .02$ on the pretest posttest confidence scale (CS). Follow-up SNK revealed significant group differences, with the athletes group recording significantly higher levels than the non-athletes ($\underline{M}$ = 3.53, sd = .74 and $\underline{M}$ = 2.41, sd = 1.05, respectively). The SNK for time indicated that scores for the posttest confidence scale were significantly higher across athleticism groups and treatment groups ($\underline{M}$ = 2.78, sd = 1.04 and $\underline{M}$ = 3.16, sd = 1.05, respectively). The SNK conducted to assess pretest differences between treatment conditions found no differences. Significant differences ($\underline{p}$ < .05) were found beween the athletes and non-athletes at pretest and posttest, the athletes achieving the higher score. Significant differences(p < .05) were also found between the non-athletes pretest and posttest scores, posttest scores being higher.

Univariate ANOVAs revealed a significant group effect, $F(1, 30) = 19.50$, $p < .0001$, and a significant time effect, $F(1, 30) = 8.11$, $p < .007$ on the pretest posttest confidence visual analogue scale (CV). The follow-up SNK revealed significant group differences, with the athletic group recording significantly higher levels than the non-athletes (M = 121.23, sd =27.22 and M = 74.86, sd = 48.84, respectively). The SNK for time indicated that scores for the posttest confidence scale were significantly higher across athleticism groups and treatment groups (M = 87.75, sd = 42.95 and M = 108.39, sd = 46.59, respectively). The SNK on pretest group levels found significant differences (p < .05) between athletes and non-athletes, athletes being more confident. Significant differences (p < .05) were also found between pretest and posttest non-athletes, the posttest group achieving the higher scores.

Analyses on Relaxation (RE)

Univaraite ANOVAs revealed a significant time effect, $F(1, 30) = 25.41$, $p < .0001$, on the pretest posttest relaxation scale (RE). The follow-up SNK revealed significant time differences, with the posttest group recording significantly higher levels than the pretest ($M = 105.78$, sd = 28.77 and $M = 80.92$, sd = 24.41, respectively). The SNKs conducted to assess pretest differences for treatment conditions found no significance. Significant differences ($p < .05$) were found between the posttest relaxation group and the posttest humor and control groups ($M = 120.\ 75$, sd = 21.74, $M = 97.17$, sd = 32.59, and $M = 99.41$, sd = 26.91 respectively), the relaxation group achieving higher scores. Significant differences ($p < .05$) were found between athletes and non-athletes ($M = 89.5$, sd = 24.05, and $M = 72.30$, sd = 22.19 respectively). Posttest relaxation scores for non-athletes were significantly higher ($p < .05$) than pretest relaxation scores for non-athletes.

Analyses on Single Measure Pain Variables

The MANOVA on the single measure pain variables (MONT, BLUNT, EXPECT) revealed a significant group effect, $F(3,28) = 2.93$, $p < .05$. Independent ANOVAs revealed a significant group effect, $F(1, 30) = 4.71$, $p < .03$, for monitors (MONT). Follow-up SNK revealed significant group differences with the non-athlete recording higher monitor scores than athletes (M = 10.94, sd = 2.39 and M = 9.16, sd = 2.45, respectively). Independent ANOVAs for blunters (BLUNT) and expectancy (EXPECT) failed to produce any significant differences.

Analyses on Heart Rate

The repeated measures MANOVA on heart rate revealed a significant effect for time, $F(5, 26) = 3.23$, $p < .02$. No treatment, group, or treatment by group interaction effects on heart rate were found to be significant. Independent ANOVAs on the lowest heart rate readings during pretreatment and posttreatment cold water pressor tests (C) revealed a significant time effect, $F(1, 30) = 11.81$, $p < .001$. Follow-up SNK indicated a significant decrease in heart rate across groups and across treatments for the variable C (M = 71.44, sd = 12.21 and M = 68.28, sd = 12.27, respectively).

Univariate ANOVAs on the highest heart rate readings during pretreatment and posttreatment cold water pressor tests (CH) revealed a significant time effect $F(1,30) = 17.24$, $p < .00031$. Follow-up SNK indicated a significant decrease in heart rate across groups and across treatments for the variable CH (M = 78.39, sd = 12.66 and M = 75.30, sd = 13.14, respectively). The group effect for CH narrowly failed to achieve significance at the $p <.05$ level, $F(1, 30) = 3.58$, $p < .06$.

The analysis revealed no significant differences pre-test or posttest between baseline and treatment heart rates for group, treatment, or the group by treatment interaction.

Correlational Analyses

Pearson r analyses within the entire group, and by group and treatment, produced correlations which in general provided validity checks for the variables selected. Pearson r analyses indicated ratings of pretest relaxation (RELAX1) to be significantly negatively correlated with anxiety (STAI1), $r = -.65$, $p < .0001$. This correlation was strengthened for the posttest, $r = -.73$, $p < .0001$. The two measures of confidence (CONFS and CONFV) were highly correlated, r scores (VASI and VASA), $r = -.38$, $p < .02$, and posttest, $r = -.54$ $p < .0006$. Scores for monitors, blunters and expestancy failed to achieve significant correlations with most of the other varaibles. Time was highly correlated with most of the pain variables, mainly as a result of the low variability in submersion times.

Confidence self-report scores (CONFS) were negatively correlated with perceived intensity of pain (VASI) at pretest, $\underline{r} = .54$, $\underline{p} < .0008$, and at posttest, $\underline{r} = .65$, $\underline{p} < .0001$. Confidence visual analogue scores (CONFV) were negatively correlated with VASI at pretest, $\underline{r} = .49$, $\underline{p} < .002$, and posttest, $\underline{r} = .66$, $\underline{p} < .001$. Similar correlations were recorded between perceived affect of pain (VASA) and both confidence scales.

General Discussion

The major objective of this study was to assess the effect of the different treatments on perceived pain tolerance (intensity and affect). The significant treatment effect obtained, when followed up with pairwise contrasts, indicated that the humor and relaxation treatments combined, significantly reduced perceived pain (intensity and affect) over the control group. While failing to support Cogan et al. (1987), these results indicate that humor has potential as a legitimate technique in reducing an individual's perception of pain. Greater sophistication in administering humor treatments may illustrate further pain attenuation applications.

A second objective of this study was to assess differences between athletes and non-athletes on their levels of perceived pain tolerance (intensity and affect). The significant differences found between athletes and non-athletes on both the pretest and posttest VASI and VASA scales further supports results reported by Davies and Hall (1987) and Jarmenko et al (1981). These results support the idea of female athletes being able to break away from the stereotypical socialization process which conditions females into have a low tolerance for pain. An alternative hypothesis could involve increased exposure to pain stimuli. Participation in athletics may increase an individual's familiarity with aversive stimuli. Past experience may increase confidence to tolerate painful situations.

The analogue scale for pain affect revealed a time effect, affective perceptin of pain being lower at posttest across groups and treatment conditions. Exposure to aversive stimuli appears to reduce the affective discomfort, both with the athletes and non-athletes were exposed to an attenuated versin of the athletic environment, which deconditions the individual, thus reducing the unpleasentness fo the sensation.

The decrease in anxiety from pretest to posttest, as measured by STAI, reflects increased famliarity with the aversive stimuli. This would appear to reduce uncertainty and apprehension, enabling the subjest to bew less anxious. As expected, athletes revealed significantly lower levels of anxiety at the pretest. This finding supports Rosillo and Fogel (1973) who contend that athletes are socialized into tolerating higher levels of pain. This socialization process would appear to prepare athletes for potenially painful experiences, thus reducing their level of anxiety. Lower anxiety ecperienced by the athletes may reflect their greater familiarity with both physical and psychological stressors. We can perhaps equate the idea of being socialized into dealing with higher levels of pain, with the idea of increasing exposure to a variety of aversive and painful stimuli over time. There is the possiblity that a Hawthorne effect may be operating to motivate the subjects to perform better on the posttest measures. The experimental situation is open to all kinds of demand characteristics, and may be partially responsible for some the treatment differences.

Reflective of the significant differences between athletes and non-athletes on the visual analogues of pain, the time factor also produces significant differences. This again was expected, although interestingly only the athletes improved significantly from pretest to posttest. Thus despite non-athletes perceiving the pain to be less aversive at the posttest, this did not affect their submersion times significantly. Athletes would appear to be more efficient in utilizing the increased proprioceptive and nociceptive (pain receptors) information, resulting not only in reduced perceived pain but increased submersion times.

Relaxation levels were higher in the athletes than the non-athletes. As with confidence levels, increases were achieved pretest to posttest which reflect the increased familiarity with the task requirements. Thus, the lowered affective dimension of the pain visual analogue may be partly due to the subjects feeling more at ease. The posttest relaxation scores (RE) were significantly higher than the humor or control group, validating the reaxation treatment technique. The relaxation treatment subjects self-reported deeper relaxation than the other treatment groups.

The measures for expectancy and blunting did not produce any differences between the groups or the treatments. This may reflect a lack of sensitivity in the questionaires designed to assess these particular dimensions. Monitors were higher in non-athletes which may be reflective of their increased uncertainty in unfamiliar situations. The results suggest that these dimensions, as measured by the current instruments, do no elucidate variations in individual pain tolerance. As Miller (1979) suggested, monitors prefer predictability under threat, placing the non-athletes at a disadvantage in this pain study. Possibly, non-athletes higher in the monitoring dimension may have a less adaptive or extensive repertoire of cognitive coping skills. This would appear to be an important consideration in the area of pain tolerance, and needs to be assessed with greater sophistication.

The correlation analyses provide support where expected, and serve as useful validity checks in the case of the anxiety and relaxation measures. Confidence scores for both self-report and visual analogue were negatively correlated with both dimensions of perceived pain (VASI and VASA), but only for the entire group.

When broken down into correlations by group and treatment, the trend was maintained although significance was low. More precise instruments may result in more informative and discriminatory correlations.

The heart rate results support Grimm and Kanfer (1976) in indicating that a reduced level of physiological arousal, as measured by heart rate, is not always accompanied by increases in perceived pain tolerance. No differences were found between or within treatments or groups. The significant decrease in heart rate levels for the entire group between the pretest and posttest cold water pressor tests validate the posttest changes in measures of relaxation, anxiety, and confidence. Greater sophistication in assessment may be needed to identify more precisely the relationship between pain and physiological response. Such measures may well have to be more intrusive than measuring heart rate.

The different results achieved between VASI and VASA support Price et al. (1983) in validating the ability of visual analogue scales to discriminate between the intensity and affective dimensions of pain.

While inconclusive, these results indicate that humor can be utilized in modifying an individual's perception of pain (intensity and affect). Additional work is needed in the area of humor before we can become unequivocal in proclaiming the therapeutic benefits. Humor is by definition a subjective interpretation, which makes the task of assessment and quantification problematic. Further research examining the role of endorphins in pain tolerance is needed to increase our understanding of the psychobiological mechanisms behind humor. Any invasive assessment measure would make the development of a "humorous atmosphere" difficult, but would increase the explanatory sophistication if feasible.

Despite the lack of unequivocal empirical support, humor appears to have potential utility in a number of applied settings. While extrapolation from laboratory settings to applied areas has a tendency to be problematic, in addition to perceived pain modification, humor may also be beneficial in areas such as pre-competitive anxiety management and in reducing training burnout.

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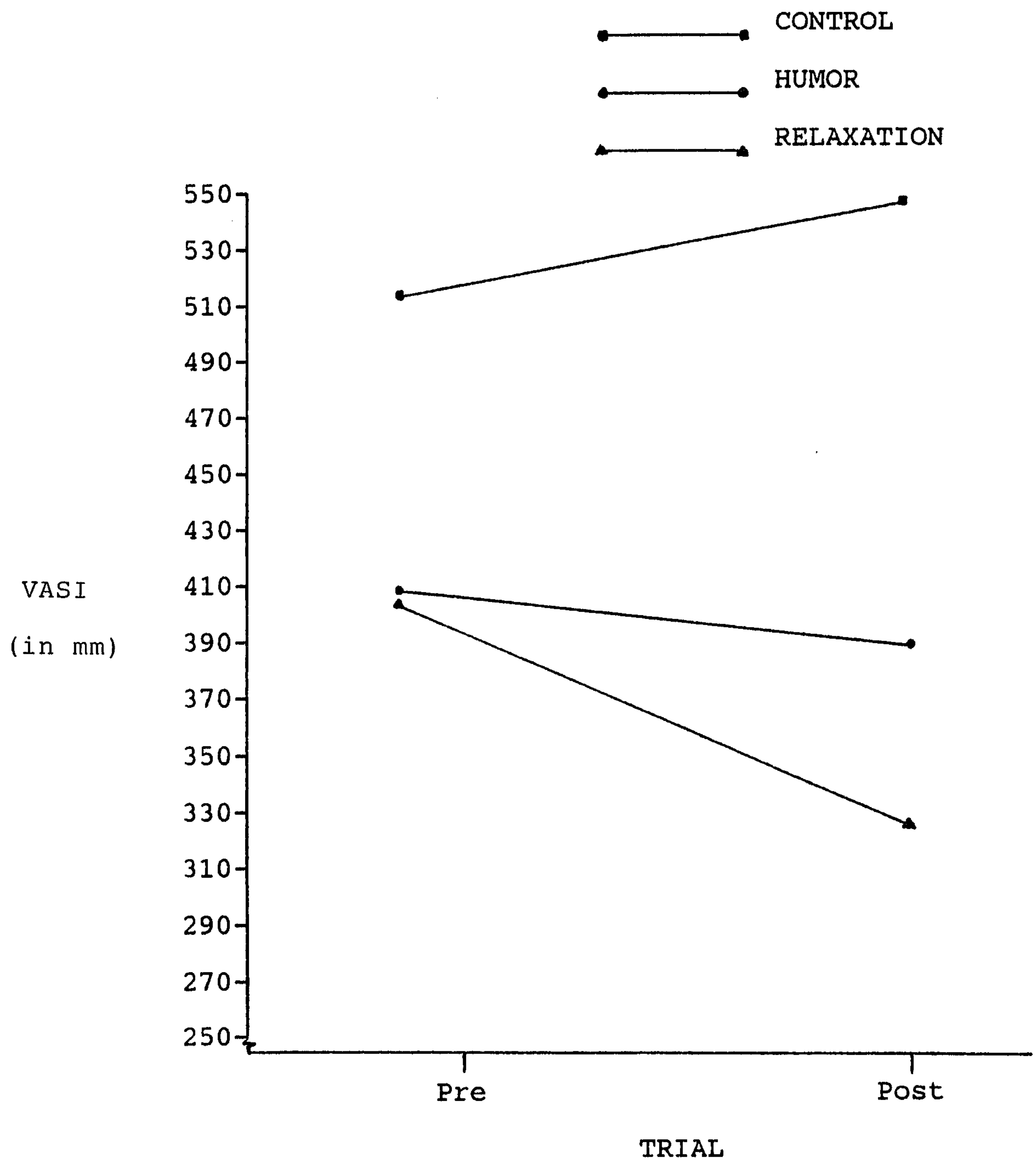
Figure captions

Figure 1. Visual analogue intensity means plotted pretreatment and posttreatment.

Figure 2. Visual analogue affect means plotted pretreatment and posttreatment.

Figure 3. Treatment condition differences for pretest posttest heart rate during cold water pressor tests.

Figure 4. Treatment condition differences for athletes and non-athletes on pretest and posttest heart rate during cold water pressor tests.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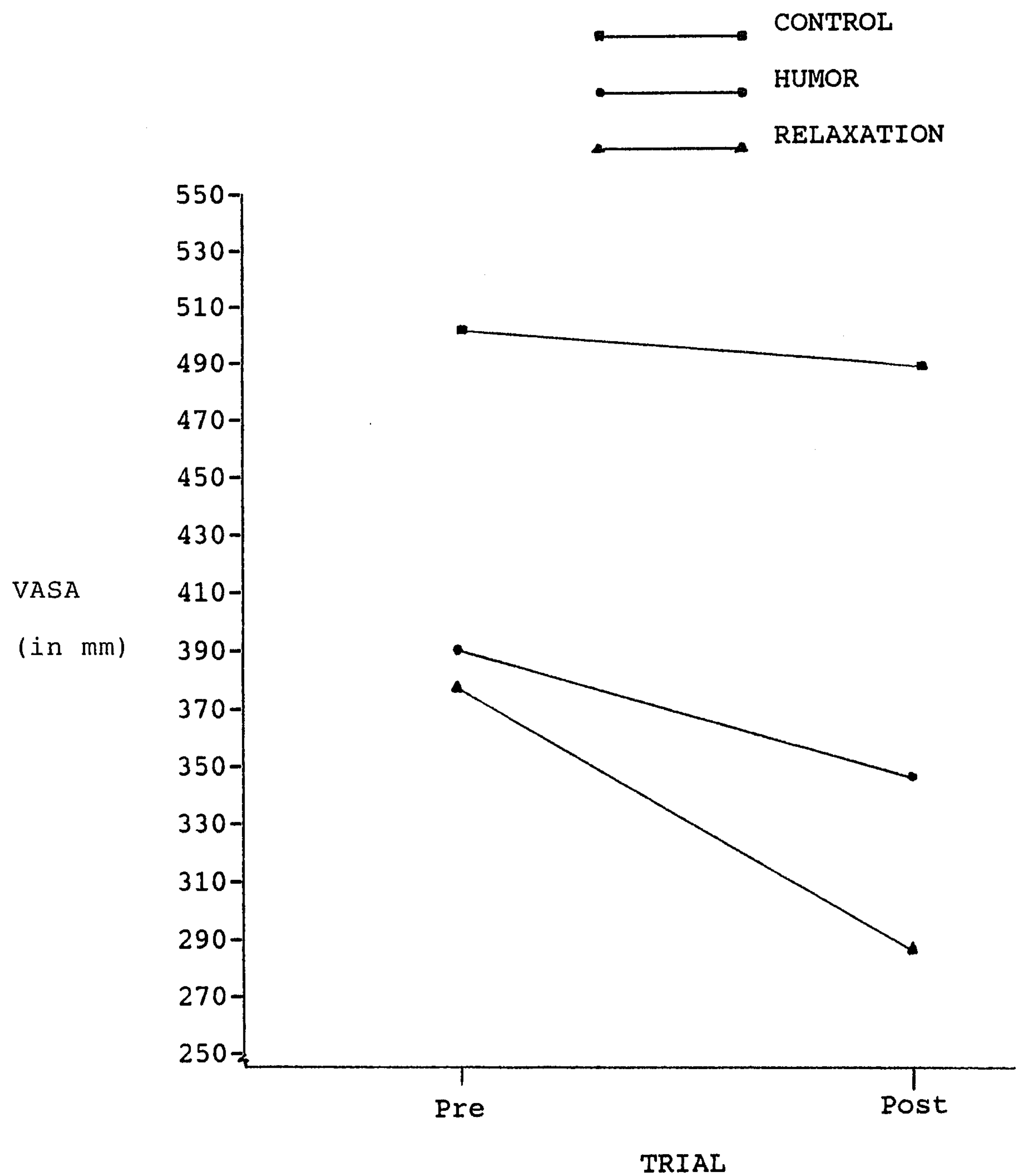
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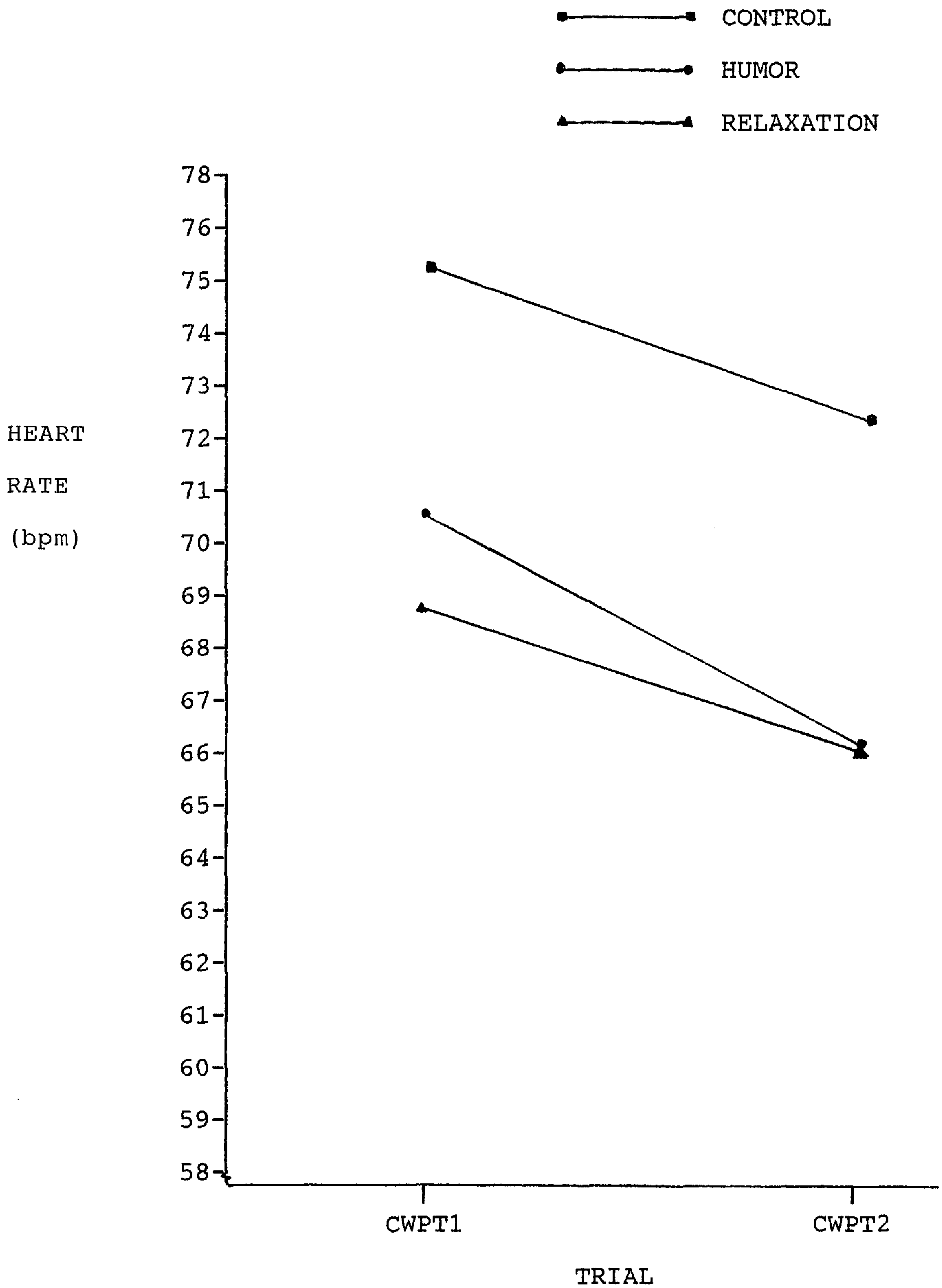
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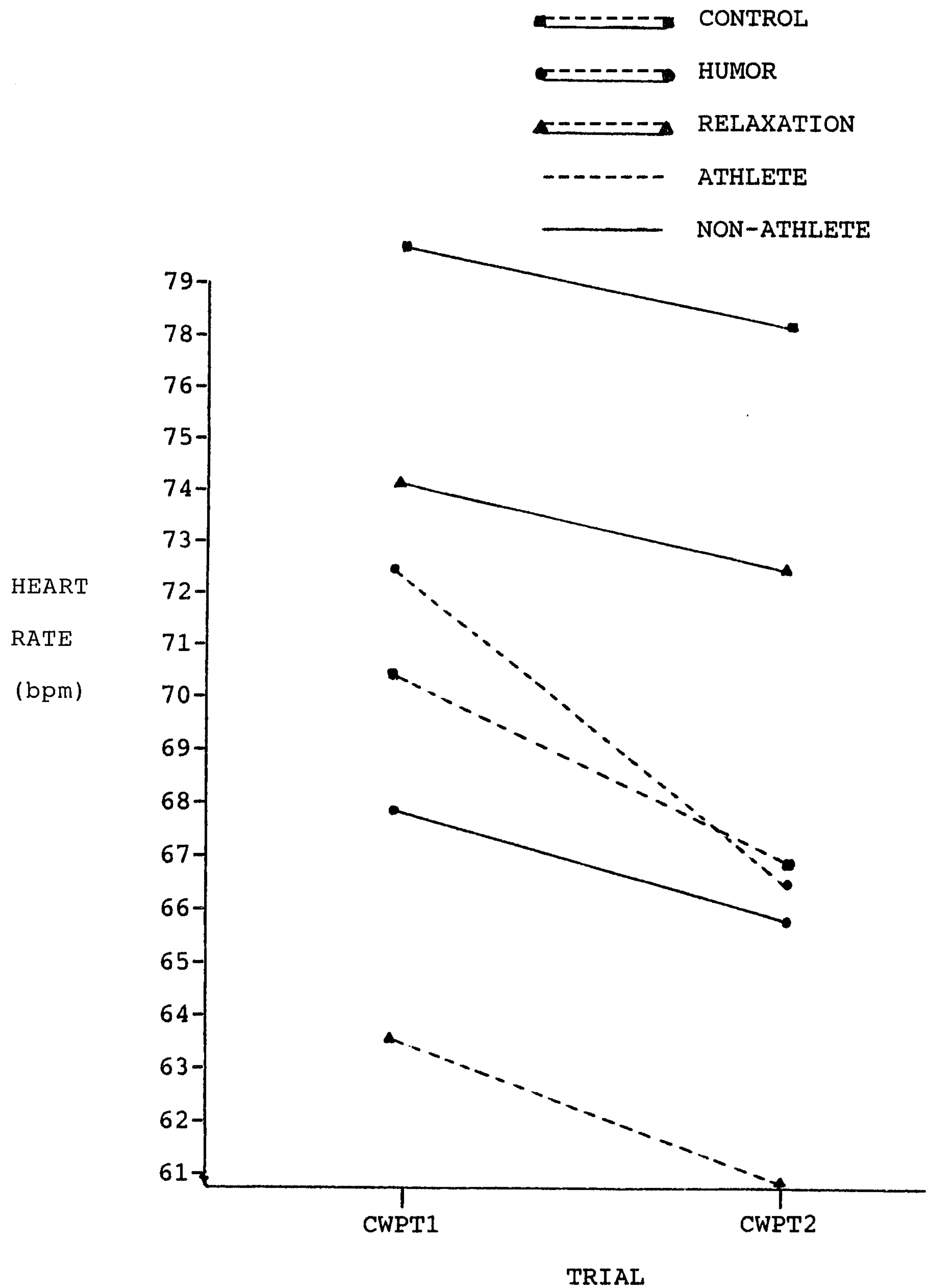
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Appendix A

Extended Review of the Literature

The Effects of Relaxation and Laughter on the Perceived Intensity and Affect of Pain Tolerance

Pain is currently conceptualized as a complex phenomenon resulting from the interaction of cognitive, motivational and sensory components (Tan, 1982). In examining pain, laboratory studies frequently employ experimentally induced pain, whether from cold pressor (tolerance to ice water) or muscle ischemia. Pain threshold, pain tolerance, and subjective pain ratings are frequently utilized as the main dependent measures. Pain threshold refers to the point at which the stimulation is just perceived as painful by the individual. Pain tolerance refers to the point at which an individual is not prepared to accept stimulation of a higher or equal magnitude (Weisenberg, 1977).

Contradictory and inconclusive data exist with regard to the impact of sex differences on pain experience, but consensus indicates that pain threshold does not vary between males and females, whereas pain tolerance is greater in males (Otto & Dougher, 1985; Wescott, Huesz, Boswell, & Herold, 1977).

Research by Petrie (1960) indicated the existence of a relationship between perceptual variables and individual pain experience, which resulted in two perceptual styles. Augmenters were found to enlarge upon the intensity of the incoming stimulus, thus increasing the subjective evaluation of what is perceived, resulting in the experience of more pain and the greater tolerance of sensory isolation. At the other end of the continuum, reducers were found to reduce the intensity of the incoming stimulus, resulting in the experience of less pain and less tolerance of sensory isolation. Women were found to reduce less than men, resulting in a lower pain tolerance. Petrie suggests that female pain perception is inextricably interwoven with the concept of survival, explaining the tendency of females not to reduce sensations which have survival value. It would appear that both cultural and perceptual style differences are partially responsible for sex differences in pain tolerance.

Miller (1979) developed the "blunting hypothesis" which stated that once an individual becomes psychologically aware of a confronting physical danger signal, cognitive strategies can be adopted which remove the individual from any further psychological awareness, lowering the arousal level. Individuals adopting the strategies which shield or remove them from danger signals are termed "blunters". Blunters tend to reduce the psychological impact of physically present danger signals. Positive strategies utilized would include reinterpretation, distraction, and self-relaxation. Less positive strategies would involve detachment, intellectualization, and denial (Vaillant, 1977). Conversely, "monitors" seek out threat-relevant information. Such individuals are able to discriminate changes in the external environment. Research by Monat, Averill and Lazarus (1972) found that subjects found it easier to distract under unpredictable conditions and under low intensity threat. Miller (1979) specified the conditions under which predicatability elicits stress reducing effects and when it does not. Subjects were classified as preferring predictabilty under threat ("monitors") or as preferring unpredicatability ("blunters").

Lazarus and Alfert (1965) demonstrated that such techniques reduced the level of psychophysiological arousal typically associated with vicarious stressors (gory films). Miller (1980) found that subjects were able to engage themselves in various cognitive strategies to blunt the psychological impact of physically present danger (colposcopy), and thus reduce arousal as measured by pulse rate. Miller (1979) also found that predictability was preferred and less arousing under invasive and intrusive conditions which did not support blunting strategies. Unpredictability was preferred and less arousing under noninvasive and nonintrusive conditions which supported blunting strategies.

Petrovich (1958), using pictures of men undergoing various painful experiences, found that the estimated pain intensity and estimated duration of pain was significantly greater by females. Woodrow, Friedman, Siegelaub and Collen (1972) induced pain by applying pressure to the achilles heel. They found that men tolerated greater pain than women, with the findings holding across age. Merksy and Spear (1964) also found that men tolerated significantly more pain than women, whereas Notermans and Tophoff (1967) found no differences in pain threshold between the sexes.

Jarmenko, Silbert and Mann (1981) reported that female athletes possessed a higher tolerance for aversive stimuli than female non-athletes, male athletes, and male non-athletes. This higher level of tolerance was demonstrated by a large rejection rate amongst the female athletes due to reaching the ceiling level on submersion time in the cold pressor pre-test. Female non-athletes showed the least tolerance on the test.

Shumate and Worthington (1987) claim that the cold pressor test has provided an analogue to acute clinical pain for which the effectiveness of various behavioral and cognitive strategies has been examined (Worthington, 1982; Worthington & Martin, 1980; Worthington, Martin & Shumate, 1982; Worthington, Martin, Shumate & Carpenter, 1983). The cold pressor test has also been used to investigate other pain control techniques such as distraction through imagery (Chaves & Barber, 1974; Greenstein, 1984; Horan & Dellinger, 1976; Scott & Leonard, 1978; Worthington, 1978; Worthington & Schumate, 1981). Davies and Hall (1987) found that female non-athletes perceived pain induced by a cold water pressor test to be significantly higher than their athletic counterparts in both affect and intensity. According to Elton, Stanley & Burrows (1983), pain has evolved into a very complex, multi-level, interacting explanatory system, involving neurological, biochemical, personality and psychosocial variables. Accepting that pain does not appear to be experienced in only one dimension, several researchers have suggested that the experience of pain sensations is not necessarily accompanied by affective feelings of being hurt (Beecher, 1959; Meichenbaum, 1977; Stevens & Heide, 1977). Gracely, Dubner and McGrath (1979) have demonstrated that the intensity and unpleasantness dimensions of pain can be assessed separately, and can thus be affected differentially by treatments.

Harris and Rollman (1983) found that measures of tolerance and threshold revealed generality and discriminant validity across stressors. They stressed that threshold judgments, which emphasized discrimination of nociceptive quality, and tolerance decisions which indicated an unwillingness to receive more intensive stimuli, are not equivalent measures of responsiveness. It would appear to be more productive to examine pain tolerance in isolation, as it is this dimension of pain which is more likely to be effected by sociological or psychological variables.

Research suggests the need to assess at least the intensity and affective dimensions of pain in attempting to gauge the individual response to aversive stimuli. The visual analogue scales (VAS) have been reported as valid and reliable measures for both the intensity and unpleasantness involved in experimental pain (Levine, Gorden, & Fields, 1982; Scott & Huskisson, 1976).

The VAS scale is considered by Scott and Huskisson (1976) to be one of the best methods available for the estimation of pain intensity. The VAS provides a continuous scale for magnitude estimation and consists of a straight line, the ends of which represent the extremes of pain experience. Carlsson (1983) suggests that the VAS format is preferable to discontinuous methods such as numerical and verbal rating scales. High correlations have been reported between VAS and numerical rating scales (Elton, Burrows, & Stanley, 1979; Ohnhaus & Adlev, 1975; Scott & Huskisson, 1976; Woodforde & Merskey, 1972).

In contrast to Jarmenko et al. (1981), the female athletes in the study conducted by Davies and Hall (1987) did not differ significantly from the male athletes on either the perceived intensity, or affect, of pain. These conflicting results may be explained by the presence of one male and one female experimenter, unlike the Jarmenko et al. study which used two male experimenters. The athletes in the study by Davies and Hall were both from NCAA Division 1 track teams, as compared to Jarmenko et al. (1981) who used NCAA Division IA males and Division II females. The findings of Davies & Hall (1987) and Iso-Ahola & Hatfield (1986) generally support the contention that female athletes indicate lower levels of perceived intensity and affect of pain, as compared to their non-athletic counterparts. Otto & Dougher (1985) contend that males and females have similar abilities to modulate attention, or to raise or lower their criteria for reporting pain, but use these capabilities differently.

Controversy exists over the superiority of taped as opposed to live relaxation training, with live relaxation techniques generally being acknowledged as being more effective in reducing tonic levels of physiological and cognitive arousal (Borkovec & Sides, 1979; Lehrer & Woolfolk, 1984). Lehrer (1982) suggests that the source of this superiority is unclear, although the presence of the therapist can offer the advantages of therapeutic warmth and provide increased opportunities to supply trainees with relevant feedback and suggestions on how to relax.

The assessment of relaxation therapies has been developed by Stefanek and Hodes (1986) who postulated that the effectiveness of relaxation therapies was related to the expectancy of success. The majority of research comparing the efficacy of live and taped relaxation training frequently failed to incorporate a measure of expectancy (Godsey, 1980; Quayle, 1980), despite Beiman (1976) finding that lower expectancies reduced the effectiveness of brief muscle relaxation training procedures. In contrast, Grimm and Kanfer (1976) found that expectancy for decreased discomfort, or progressive muscle relaxation, failed to increase cold pressor tolerance over a control group, whereas subjects engaged in verbal/symbolic activities increased their tolerance significantly. The verbal/symbolic group were trained in the use of potential controlling rsponses consisting of pleasant thoughts and scenes.

Stefanek and Hodes (1986) examined the effect of self, taped, and live relaxation instructions on physiological and self-report measures of anxiety under conditions of low and high treatment expectancy. They found that for all three relaxation procedures, the number of response systems benefitting from training was maximized when relaxation was provided within the context of high expectancy for change. Using a modified version of the Borkovec and Nau (1972) expectancy assessment instrument (modified to emphasize learning the ability to reduce general tension and anxiety), Stefanek and Hodes found that palpable effects were produced across both physiological (heart rate, spontaneous skin fluctuations, finger pulse) and verbal (self-report) response systems. Self-report was measured using the Anxiety Differential (Husek & Alexander, 1963).

In contrast, Grimm and Kanfer (1976) found that significant heart rate decreases were only found in the verbal/symbolic activities and relaxation treatment groups. The expectancy for decreased discomfort group (induced from educational information and experimental reports on ice pressor tolerance decreasing from pre to post test as a result of physical adaptation) failed to achieve any post-test increase in tolerance level. Thus, expectancy alone, without the associative influence of relaxation, does not appear to increase tolerance to ice-water pain. Grimm and Kanfer (1976) also stress that the failure to note increases in tolerance (beyond the control group) by the relaxation-analog group in conjunction with decreases in heart rate, suggests that autonomic change alone is not sufficient to affect pain tolerance.

Kazdin and Wilcoxon (1976) suggest that changed expectancy is the basis of therapeutic effects, although Wolpe (1982) emphasizes that they offer no evidence for the therapeutic efficacy of expectancy. Wolpe (1982) suggests that there are only two possible therapeutic roles for expectancy which are discernible. Expectancy implies a hopeful belief which may displace contrary cognitions and any associated fears, this aroused expectancy possibly competing with anxiety.

Research (Isen, 1985; Isen, Daubman, & Nowicki, 1987; Isen & Gorgoglione, 1983) exists which attests to the impact of positive affective states on cognitive performance. Laughter has been found to be superior to relaxation and other audio distractions (Cogan et al., 1987) on pressure-induced discomfort thresholds, although there has not been any research on the impact of these techniques on perceived pain tolerance.

While research indicates that female athletes are more tolerant of pain than non-athletic females (Davies & Hall, 1987; Jarmenko et al. 1981) there is speculation as to the reasons for this difference. As relaxation techniques (Jacobson, 1938) can be classified as learned skills which require a period of training in order to gain proficiency, this may explain differences in the ability of individuals to utilize this technique. Elite athletes have mastered a variety of learning strategies, which are prerequisites for skill acquisition, and may have access to a more extensive schema system (Schmidt, 1975). The ability to achieve competence in relaxation may place athletic females at an advantage in tolerating cold-pressor pain.

Laughter, according to Cogan et al. (1987), is naturally occurring and effortless, and has been found to be potentially more beneficial than other behavioral techniques for reducing pain sensitivity. If the efficacy differences between relaxation and laughter in tolerating pressure-induced discomfort thresholds (Cogan et al., 1987) can be generalized to the cold-pressor test and to an athletic population, we may have to revise our use of classic relaxation techniques in sport.

Despite numerous anecdotal references to the therapeutic effectiveness of laughter (Hopson, 1988), empirical support is sparse. There have been attempts to link the cause of laughter's beneficial affects to endorphins. Temporary respite from severe pain appears to be connected to the relief of brain opiates which are activated as a survival mechanism, producing natural pain relief. Researchers have located a pain control system in the periaqueductal gray (PAG), a central region within the brain responsible for the production of opioid peptides. Without understanding the mechanisms, it has been found that if the PAG is jolted with electrical current, chronic pain can be reduced.

Gintzler (1980) has postulated that the endorphin-mediated increases in pain tolerance occur during human pregnancy. In experiments with rats, pain threshold increases were abolished by the long-term administration of the narcotic antagonist naltrexone. Baron and Ginttzler (1987) have suggested that pregnancy-induced analgesia depends upon central rather than peripheral opioid systems.

In assessing the role of endorphins and exercise, Morgan (1985) suggests that there is a tenable, but as yet not empirical, relationship between exercise and improved mood. The improved mood may be the result of: 1. distraction, 2. monoamine release, or 3. endorphin release. Farrell (1985) reported that an increase in the peripheral plasma levels of beta endorphins in humans after exercise has been noted by all investigators to date. These findings apply equally well to females, where McArthur (1985) has reported a 2 to 3 fold increase over basal levels. Numerous researchers (see review by Sutton, 1984) support the analgesic properties of endorphins, which appear to be mediated via specific receptors.

Accepting the analgesic properties of endorphins, which are activated in someway by physical exertion or exercise, we need to examine the effect on pain perception. Janal, Colt, Crawford-Clark, and Glausman (1984) examined the relationship between pain sensitivity, mood, and plasma levels in males following long-distance running. In comparing the effects induced by naloxone (opioid inhibitor) and saline (placebo), Janal et al. found that under saline conditions, discriminability was significantly reduced post-run, a hypoalgesic effect. Ischemic pain reports were significantly reduced post-run, also a hypoalgesic effect. Joy, euphoria, cooperation, and conscientiousness were also increased post-run. Nalaxone reversed the post-run ischemia but not the thermal hypoalgesic effects. The naloxone effects suggests that the endogenous opioid neural systems are not mechanisms for all the run-induced alterations in mood and pain perception. These results are consistent with the findings of Haier (1981) and Colt, Wardslaw, and Frantz (1981). Perhaps the best way to assess the laughter-endorphin link would be to tap the cerebrospinal fluid, which Fry (1988) suggests is difficult and not conducive to laughter.

Conclusions

This review of literature indicates that further research is still needed to assess the efficacy of humor as a modulator of pain tolerance. Three main questions were postulated in this study. First, what role does laughter play in modulating pain tolerance, from both an affect and intensity perspective? Second, does gender have an influence in pain tolerance? Thirdly, what role do endorphins have in pain tolerance?

Whilst empirical evidence for the therapeutic benefit of laughter is limited, anecdotal support is both impressive and diverse. Currently, the mechanisms responsible are not clearly understood.

In examining the effect of gender on pain tolerance, Davies & Hall (1987) report that female athletes achieve lower levels of perceived intensity and affect of pain, in comparison with female non-athletes. Athletic participation, at least at the more elite level, appears to be instrumental in overcoming the traditional socialization process. Female athletes are more similar to males in their ability to tolerate pain.

Various researchers suggest that endorphins are instrumental in modifying pain tolerance (whether in an exercise or clinical setting), although assessment is complicated by measurement limitations and great individual variation in response to treatments.

Intrusive assessment has the potential for being highly accurate, but is generally incompatible with engendering a state of laughter!

With the addition of more empirical evidence the parameters and relationships between laughter and pain tolerance will be more clearly understood, facilitating greater practical application.

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Appendix B

Biographical Data Sheet

Appendix B

The Biographical Questionnaire

BIOGRAPHICAL DATA SHEET

Please answer the following questions. There are no right or wrong answers. Your information will be kept in strictest confidence. Some questions may not apply to you, please mark these questions with "N/A".

1. Name (please print in block capitals):

2. Date of Birth:

3. Height: 4. Weight:

5. Place of Birth (give town and state):

6. Please list any sports or recreational activities in which you have participated on a regular basis. Include the number of years of involvement, and your highest level of representation (i.e., recreational, high school, state, varsity, e.t.c.):

7. Please list any sport or recreational injuries you have suffered (include approximate age at the time of injury):

8. Please list any brothers and sisters you have, include ages:

9. Please list any sports played (now or previously) by your parents or brothers/sisters. Give the highest level of performance achieved by each individual in each sport you list (i.e., recreational, high school, state, varsity, e.t.c.):

10. What sports or recreational activities did you play at high school? Please list how frequently you participated in each activity listed (e.g. softball: twice a week during spring semester, from age 12 to 16),and at what level you played at (i.e., tennis: school team; swimming: recreational; track: all-state). Please state whether your participation was voluntary or compulsory:

11. Which of the following statements applies to you?
a. I have never enjoyed sports.
b. I participate in competitive sports on a regular basis.
c. I enjoy sports but do not have the time to participate.
d. I engage in a limited number of sports in order to maintain a reasonable level of fitness.
e. I enjoy sports on a recreational basis.

12. What career do you wish to pursue upon graduating?

13. Do you belong to any sports clubs, either on or off campus?

Please list these clubs, indicating what activities you participate in, and how many hours you spend on them each week.

14. How many hours do you spend a week playing sport or participating in physical recreation?
a. less than one.
b. between two and three.
c. between four and five.
d. more than five (specify number of hours).

15. Do you think that sports should be compulsory at high school or university (if your answer is yes, please suggest the number of hours and the type of sports)?

16. List the sports (in order of preference) you would participate in if time and money were no object.

17. Assuming sport was compulsory at university, would you choose a physical contact or non-physical contact sport? (explain your choice).

Appendix C

Visual Analogue Scales

Appendix C

Visual Analogue Scales

INSTRUCTIONS

MARK THESE TWO LINES ACCORDING TO HOW STRONG (INTENSITY) OR UNPLEASANT YOU FIND THE PAIN. THE FURTHER TO THE RIGHT YOU MARK THE LINE,THE GREATER THE STRENGTH/INTENSITY OR UNPLEASANTNESS.

STRENGTH OF PAIN (INTENSITY)

HOW STRONG THIS PAIN FEELS TO YOU

NO SENSATION — STRONGEST I CAN IMAGINE

AFFECT OF PAIN (UNPLEASANTNESS)

HOW UNPLEASANT THIS PAIN FEELS TO YOU.

NOT BAD AT ALL — THE MOST INTENSE BAD FEELING FOR ME

Appendix D

Relaxation Protocol

Muscle Groups and Directions for Relaxation

1. Fist of right hand. "First think about your right arm, your right arm in particular. Clench your fist tight. Clench it tightly and study the tension in the hand and in the forearm. Study those sensations of tension. (Pause.). Now let go. Just relax the right hand and let it rest on the arm of the chair. (Pause). Note the difference between the tension and the relaxation".

2. Wrist of right arm. "Now bend your right hand back at the wrist so that you tense the muscles in the back of the hand and in the forearm. Point your fingers towards the ceiling. Study the tension, and now relax. (Pause). Study the difference between tension and relaxation." (10-second pause).

3. Right bicep. "Now clench your right hand into a fist and bring it towards your shoulder. As you do this, tighten your bicep muscles, the ones in the upper part of your arm. Feel the tension in these muscles (Pause). Now relax. Let your arm drop down to your side. See the difference between the tension and the relaxation." (10-second pause).

4. Shoulders. "Now we'll move to the shoulder area. Shrug your shoulders. Bring them up to your ears. Feel

and hold the tension in your shoulders. (Pause). Now, let both shoulders relax. Note the contrast between the tension and the relaxation that's now in your shoulders." (10-second pause).

5. Forehead. "Now we'll work on relaxing the various muscles of the face. First, wrinkle up your forehead and brow. Do this until you feel your brow furrow. (Pause). Now relax. Smooth out the forehead. Let it loosen up." (10-second pause).

6. Eyes. "Now close your eyes tightly. Can you feel tension all around your eyes? (5-second pause). Now relax those muscles, noting the difference between the tension and the relaxation." (10-second pause).

7. Tongue or jaws. "Now clench your jaws by biting your teeth together. Pull the corners of your mouth back. Study the tension in the jaws. (5-second pause). Relax your jaws now. Can you tell the difference between the tension and relaxation in your jaw area?" (10-second pause).

8. Pressing the lips together. "Now press your lips together tightly. As you do this, notice the tension around all the mouth. (Pause). Now relax those muscles around the mouth. Enjoy this relaxation in your mouth

area and your entire face." (Pause).

9. The head. "Now we'll move to the neck muscles. Press your head back against your chair. Can you feel the tension in the back of your neck and in your upper back? Hold the tension. (Pause). Now let your head rest comfortably. Notice the difference. Keep on relaxing." (Pause).

10. Chin in chest. "Now continue to concentrate on the neck area. Bring the head forward. See if you can bury your chin into your chest. Note the tension in the front of your neck. Now relax and let go." (10-second pause).

11. The back. "Now direct your attention to your upper back area. Arch your back like you're sticking out your chest and stomach. Can you feel the tension in your back? Study that tension. (Pause). Now relax. Note the difference between the tension and the relaxation." (10-second pause).

12. Chest muscles. "Now take a deep breath, filling your lungs, and hold it. Feel the tension all through your chest and into your stomach area. Hold that tension. (Pause). Now relax and let go. Let your breath out naturally. Enjoy the pleasant sensations." (10-second pause).

13. Stomach muscles. "Now think about your stomach. Tighten up the muscles in your abdomen, pulling your stomach in. Hold this. Make the stomach like a knot. Now relax. Loosen those muscles now." (10-second pause).

14. Legs. "I'd like you now to focus on both legs. Stretch both legs. Feel the tension in the thighs (5-second pause). Now relax. Study the difference again between the tension in the thighs and the relaxation you feel now." (10-second pause).

15. Toes. "Now concentrate on your lower legs and feet. Tighten both calf muscles by pointing your toes toward your head. Pretend a string is pulling your toes up. Can you feel the pulling and the tension? Note that tension. (Pause). Now relax. Let your legs relax deeply. Enjoy the difference between tension and relaxation." (10-second pause).

<u>Note</u>: Each muscle group is tensed and relaxed twice.

Appendix E

Miller Behavioral Style Scale

Miller Behavioral Style Scale

1. Vividly imagine that you are <u>afraid</u> of the dentist and have to get some dental work done. Which of the following would you do? Check <u>all</u> of the statements that might apply to you.

__ I would ask the dentist exactly what he was going to do.

__ I would take a tranquilizer or have a drink before going.

__ I would try to think about pleasant memories.

__ I would want the dentist to tell me when I would feel pain.

__ I would try to sleep.

__ I would watch all the dentist's movements and listen for the sound of his drill.

__ I would watch the flow of water from my mouth to see if it contained blood.

__ I would do mental puzzles in my mind.

2. Vividly imagine that you are being held hostage by a group of armed terrorists in a public building. Which of the following would you do? Check <u>all</u> of the statements that might apply to you.

__ I would sit by myself and have as many daydreams and fantasies as I could.

__ I would stay alert and try to stop myself from falling asleep.

__ I would exchange life stories with the other hostages.

__ If there was a radio present, I would stay near it and listen to the bulletins about what the police were doing.

__ I would watch every movement of my captors and keep an eye on their weapons.

__ I would try to sleep as much as possible.

__ I would think about how nice it's going to be when I get home.

__ I would make sure I knew where every possible exit was.

3. Vividly imagine that, due to a large drop in sales, it is rumored that several people in your department at work will be laid off. Your supervisor has turned in your evaluation of your work for the past year. The decision about lay-offs has been made and will be announced in several days. Check all the statements that might apply to you.

__ I would talk to my fellow workers to see if they knew anything about what the supervisor's evaluation of me said.

__ I would review the list of duties for my present job and try to figure out if I had fulfilled them all.

__ I would go to the movies to take my mind off of things.

__ I would push all thoughts of being laid off out of my mind.

__ I would try to think which employees in my department the supervisor might have thought had done the job worst.

__ I would continue doing my work as if nothing special was happening.

4. Vividly imagine that you are on an airplane, thirty minutes from your destination, when the plane unexpectedly goes into a deep dive and then suddenly levels off. After a short time, the pilot announces that nothing is wrong, although the rest of the ride may be rough. You, however, are not convinced that all is well. Check of the statements that might apply to you. I would carefully read the information provided about safety features in the plane and make sure that I knew where the emergency exists were. I would make small talk with the passenger beside me.

__ I would watch the movie end, even if I seen it before.

__ I would call for the stewardess and ask her exactly what the problem was.

__ I would order a drink or tranquilizer from the stewardess.

__ I would listen carefully to the engines for unusual noises and would watch the crew to see if their behavior was out of the ordinary.

__ I would talk to a passenger beside me about what was wrong.

__ I would settle down and read a book/magazine or write a letter.

Appendix F

Expectancy Questionnaire

Expectancy Questionnaire

For each of the following statements, rate the treatment on each of the following 10-point credibility/expectancy for improvement scales:

1. How logical does this type of treatment seem to you?

1	2	3	4	5	6	7	8	9	10
Low									High

2. How confident are you that this treatment will be successful in increasing your tolerance to the cold water pressor test?

1	2	3	4	5	6	7	8	9	10
Low									High

3. How confident would you be in recommending this treatment to a friend who wanted to increase their tolerance to cold water?

1	2	3	4	5	6	7	8	9	10
Low									High

4. How successful do you feel this treatment would be in decreasing a different kind of unpleasant feeling, for example, dental surgery?

1	2	3	4	5	6	7	8	9	10
Low									High

Appendix G

Self-Evaluation Questionnaire

Self-Evaluation Questionnaire

DIRECTIONS: A NUMBER OF STATEMENTS WHICH PEOPLE HAVE USED TO DESCRIBE THEMSELVES ARE GIVEN BELOW. READ EACH STATEMENT AND THEN CIRCLE THE APPROPRIATE NUMBER (1 = NOT AT ALL, PROGRESSING THROUGH 2, 3, 4, 5, 6, TO 7 = VERY MUCH SO) TO INDICATE HOW YOU FEEL RIGHT NOW, THAT IS AT THIS MOMENT. THERE ARE NO RIGHT OR WRONG ANSWERS, SELECT THE NUMBER WHICH BEST REPRESENTS YOUR PRESENT FEELINGS. DO NOT SPEND TOO MUCH TIME ON ANY ONE STATEMENT.

1. I AM RELAXED

1 2 3 4 5 6 7

NOT AT ALL VERY MUCH SO

2. I FEEL CALM

1 2 3 4 5 6 7

NOT AT ALL VERY MUCH SO

3. I AM TENSE

1 2 3 4 5 6 7

NOT AT ALL VERY MUCH SO

4. I FEEL AT EASE

1 2 3 4 5 6 7

NOT AT ALL VERY MUCH SO

5. I AM JITTERY

1 2 3 4 5 6 7

NOT AT ALL VERY MUCH SO

Appendix H

Relaxation Scale

Relaxation Scale

HOW RELAXED DO YOU FEEL AT THIS MOMENT? MARK THE LINE ACCORDING TO HOW YOU FEEL. THE RANGE OF RELAXATION IS FROM ZERO RELAXATION TO TOTAL RELAXATION.

zero relaxation	total relaxation

Appendix I

Confidence Level

Confidence Level

HOW CONFIDENT ARE YOU THAT YOU WILL BE ABLE TO KEEP YOUR HAND SUBMERSED IN THE ICE WATER FOR? MARK THE LINE WHICH BEST REPRESENTS YOUR PRESENT LEVEL OF CONFIDENCE.

________	________	________	________
Not at all Confident	Somewhat Confident	Moderately Confident	Very Confident

PLEASE MARK THE FOLLOWING LINE WHICH REPRESENTS A CONFIDENCE FOR ICE-WATER TOLERANCE CONTINUUM. THE RANGE IS FROM 0% CONFIDENCE TO 100% CONFIDENCE. MARK ANYWHERE ALONG THE LINE, INDICATING HOW CONFIDENT YOU FEEL THAT YOU WILL BE ABLE TO KEEP YOUR HAND SUBMERSED IN THE ICE-WATER <u>FOR AT LEAST FIVE MINUTES</u>.

____

0% --------------------------------> 100%

Confidence Confidence

Appendix J

Subject Consent Form

Subject Consent Form

*TO BE RETAINED BY THE EXPERIMENTER Date: __________

Subject #: __________

EXPERIMENT SIGN-UP FORM

My signature, on this sheet, by which I volunteer to participate in the experiment on tolerance of cold pressor stimulation, conducted by

Mr. Simon Davies

(Experimenter),

indicates that I understand that all the subjects in the project are volunteers, that I can withdraw at any time from the experiment, that I have been or will be informed as to the nature of the experiment, that the data I provide will be anonymous and my identity will not be revealed without my permission, and that my performance in this experiment may be used for additional projects. Finally, I shall be given the opportunity to ask questions prior to the start of the experiment and after my participation is complete.

____

Subject's Signature

Appendix K

Descriptive Statistics

Table 1

Descriptive Statistics for Treatment Groups on VI1

Treatment Groups		M	SD	Range
Control:	Athletes	463.17	216.77	193-715
	Non-Athletes	584.00	183.51	293-750
Humor:	Athletes	385.50	139.97	296-535
	Non-athletes	429.33	207.84	161-69
Relaxation:	Athletes	263.83	95.47	85-453
	Non-Athletes	548.67	147.57	413-750

Table 2

Descriptive Statistics for Treatment Groups on VI2

Treatment Group		M	SD	Range
Control:	Athletes	502.33	177.43	254-715
	Non-Athletes	562.00	207.54	250-750
Humor:	Athletes	349.83	100.88	222-535
	Non-athletes	442.33	127.48	251-694
Relaxation:	Athletes	211.17	123.63	57-453
	Non-Athletes	450.67	229.69	257-750

Table 3

Descriptive Statistics for Treatment Groups on VA1

Treatment Groups		M	SD	Range
Control:	Athletes	395.33	268.42	97-733
	Non-Athletes	584.00	180.65	311-750
Humor:	Athletes	323.83	104.95	186-509
	Non-athletes	424.67	165.58	197-624
Relaxation:	Athletes	226.17	104.18	60-336
	Non-Athletes	544.67	164.54	318-750

Table 4

Descriptive Statistics for Treatment Group on VA2

Treatment Groups		M	SD	Range
Control:	Athletes	427.33	193.10	194-733
	Non-Athletes	552.67	226.06	224-750
Humor:	Athletes	248.50	109.86	146-509
	Non-athletes	398.33	101.09	234-624
Relaxation:	Athletes	180.00	78.57	77-336
	Non-Athletes	397.83	237.21	213-750

Appendix L

MANOVA and ANOVA Tables

Table 5

MANOVA for Repeated Measures Pain Variables.

Source	df	F	PR > F
Group	7, 24	2.78	0.0290
Treat	14, 46	1.30	0.2419
Group*Treat	14, 46	7.59	0.0001
Time	7, 24	6.72	0.0002
Group*Time	7, 24	1.29	0.2950
Treat*Time	14, 46	2.65	0.0066
Group*Treat*Time	14, 46	0.96	0.5048

Table 6

ANOVA analysis for pretest posttest visual analogue for intensity (I).

Source	df	SS	F	PR > F
Group	1	355746.12	6.89	0.0131
Treat	2	340180.02	3.29	0.0509
Group*Treat	2	134397.25	1.30	0.2871
Time	1	11832.35	2.24	0.1453
ID(Group*Treat)	30	1549340.42		
Group*Time	1	1770.12	0.33	0.5673
Treat*Time	2	2331.36	2.20	0.1280
Group*Treat*Time	2	10130.25	0.96	0.3954
Time*ID(Gr*Treat)	30	158744.42		

Table 7

ANOVA analysis for pretest posttest visual analogue for affect (A).

Source	df	SS	F	PR < F
Group	1	579426.12	10.79	0.0026
Treat	2	342492.69	3.19	0.0555
Group*Treat	2	80102.08	0.75	0.4831
Time	1	36315.12	6.84	0.0138
ID(Group*Treat)	30	1611566.12		
Group*Time	1	13203.12	2.49	0.1253
Treat*Time	2	26202.58	2.47	0.1018
Group*Treat*Time	2	10651.08	1.00	0.3787
Time*ID(Gr*Treat)	30	159288.58		

Table 8

ANOVA analysis for pretest posttest state anxiety (STAI).

Source	df	SS	F	PR > F
Group	1	107.55	2.62	0.1161
Treat	2	26.36	0.32	0.7280
Group*Treat	2	19.53	0.24	0.7899
Time	1	382.72	39.91	0.0001
ID(Group*Treat)	30	1232.33		
Group*Time	1	0.05	0.01	0.9398
Treat*Time	2	12.19	0.64	0.5365
Group*Treat*Time	2	1.36	0.07	0.9316
Time*ID(Gr*Treat)	30	287.67		

Table 9

ANOVA analysis for the pretest posttest confidence scales (CS).

Source	df	SS	F	PR > F
Group	1	22.22	20.20	0.0001
Treat	2	0.86	0.39	0.6795
Group*Treat	2	2.86	1.30	0.2873
Time	1	2.72	5.33	0.0281
ID(Group*Treat)	30	33.00		
Group*Time	1	0.89	1.74	0.1972
Treat*Time	2	1.02	1.01	0.3779
Group*Treat*Time	2	1.02	1.01	0.3779
Time*ID(Gr*Treat)	30	15.33		

Table 10

ANOVA analysis for the pretest posttest confidence analogues (CV).

Source	df	SS	F	PR > F
Group	1	38781.12	19.50	0.0001
Treat	2	3378.36	0.85	0.4376
Group*Treat	2	4388.58	1.10	0.3448
Time	1	7667.35	8.11	0.0079
ID(Group*Treat)	30	59651.00		
Group*Time	1	3081.12	3.26	0.0810
Treat*Time	2	1287.53	0.68	0.5137
Group*Treat*Time	2	1620.08	0.86	0.4345
Time*ID(Gr*Treat)	30	28351.42		

Table 11

ANOVA analysis for the posttest relaxation levels (RE).

Source	df	SS	F	PR > F
Group	1	2080.12	2.29	0.1405
Treat	2	728.03	0.40	0.6731
Group*Treat	2	938.25	0.52	0.6015
Time	1	11125.35	25.41	0.0001
ID(Group*Treat)	30	27220.42		
Group*Time	1	741.12	1.69	0.2031
Treat*Time	2	4052.03	4.63	0.0177
Group*Treat*Time	2	938.58	1.07	0.3551
Time*ID(Gr*Treat)	30	13134.42		

Table 12

ANOVA analysis for the pretest posttest time factor (TM).

Source	df	SS	F	PR > F
Group	1	58311.12	4.99	0.0331
Treat	2	64866.86	2.77	0.0784
Group*Treat	2	29359.75	1.26	0.2994
Time	1	1932.35	2.81	0.1043
ID(Group*Treat)	30	350716.08		
Group*Time	1	1275.12	1.85	0.1837
Treat*Time	2	3711.36	2.70	0.0838
Group*Treat*Time	2	3003.58	2.18	0.1305
Time*ID(Gr*Treat)	30	20653.08		

Table 13

MANOVA analysis for single measure pain variables (MONT, BLUNT, EXPECT).

Source	df	F	PR > F
Group	3, 28	2.93	0.0507
Treat	6, 54	1.91	0.0954
Group*Treat	6, 54	0.32	0.9229

Table 14

ANOVA analysis for monitors (MONT).

Source	df	SS	F	PR > F
Group	1	28.44	4.71	0.0381
Treat	2	15.39	1.27	0.2947
Group*Treat	2	2.72	0.23	0.7977
ID(Group*Treat)	30	181.33		

Table 15

ANOVA analysis for blunters (BLUNT).

Source	df	SS	F	PR > F
Group	1	0.44	0.10	0.7561
Treat	2	20.39	2.25	0.1224
Group*Treat	2	2.39	0.26	0.7696
ID(Group*Treat)	30	135.67		

Table 16

ANOVA analysis for expectancy (EXPECT).

Source	df	SS	F	PR > F
Group	1	96.69	2.47	0.1265
Treat	2	152.39	1.95	0.1603
Group*Treat	2	53.72	0.69	0.5112
ID(Group*Treat)	30	1174.17		

Table 17

MANOVA analysis for heart Rate Data

Source	df	F	PR > F
Group	6, 25	1.22	0.3302
Treat	12, 48	0.70	0.7402
Group*Treat	12, 48	0.78	0.6710
Time	5, 26	3.23	0.0213
Group*Time	5, 26	0.52	0.7577
Treat*TIme	10, 50	0.14	0.9991
Group*Treat*Time	10, 50	0.51	0.9891

Table 18

ANOVA analysis for low heart rate for pretreatment and posttreatment cold water pressor tests (C).

Source	df	SS	F	PR > F
Group	1	734.72	2.79	0.1053
Treat	2	587.53	1.12	0.3411
Group*Treat	2	750.03	1.42	0.2566
Time	1	180.50	11.81	0.0017
ID(Group*Treat)	30	7902.33		
Group*Time	1	40.50	2.65	0.1141
Treat*TIme	2	13.58	0.44	0.6455
Group*Treat*Time	2	4.75	0.16	0.8568
Time*ID(Gr*Treat)	30	458.67		

Table 19

ANOVA analysis for high heart rate for pretreatment and posttreatment cold water pressor tests (CH).

Source	df	SS	F	PR > F
Group	1	1081.12	3.58	0.0682
Treat	2	610.53	1.01	0.3760
Group*Treat	2	568.75	0.94	0.4012
Time	1	171.12	17.24	0.0003
ID(Group*Treat)	30	9060.42		
Group*Time	1	21.12	2.13	0.1550
Treat*TIme	2	0.25	0.01	0.9875
Group*Treat*Time	2	12.25	0.62	0.5462
Time*ID(Gr*Treat)	30	297.75		

Table 20

ANOVA analysis for low heart rate during baseline phase (BASEL).

Source	df	SS	F	PR > F
Group	1	280.05	0.97	0.3321
Treat	2	481.33	0.84	0.4437
Group*Treat	2	1045.78	1.81	0.1804
ID(Group*Treat)	30	8646.33		

Table 21

ANOVA analysis for high heart rate during baseline phase (BASEH).

Source	df	SS	F	PR > F
Group	1	420.50	1.39	0.2481
Treat	2	321.78	0.53	0.5936
Group*Treat	2	1024.00	1.69	0.2018
ID(Group*Treat)	30	9094.33		

Table 22

ANOVA analysis for low heart rate during treatment phase (TXL).

Source	df	SS	F	PR > F
Group	1	612.50	3.49	0.0714
Treat	2	602.33	1.72	0.1968
Group*Treat	2	613.00	1.75	0.1915
ID(Group*Treat)	30	5261.67		

Table 23

ANOVA analysis for high heart rate during treatment phase (TXH).

Source	df	SS	F	PR > F
Group	1	734.72	3.63	0.0664
Treat	2	533.33	1.32	0.2829
Group*Treat	2	716.44	1.77	0.1877
ID(Group*Treat)	30	6073.00		

Appendix M

Cell Means
Standard Deviations
Range

Table 24

Heart rate cell means, standard deviations and ranges (by athlete and treatment groups).

Group	N	C	CH	BASEL	BASEH	TXL	TXH
1	36	66.667	72.972	71.444	77.444	63.167	69.055
2	36	73.055	80.722	75.389	82.278	69.000	75.444

Treat	N	C	CH	BASEL	BASEH	TXL	TXH
1	24	68.250	75.000	72.583	79.083	66.167	72.250
2	24	67.458	74.583	70.750	77.750	62.500	68.917
3	24	73.875	80.958	76.917	82.750	69.583	75.583

GROUP	TREAT	BALM	BAHM	CWL1M	CWH1M	TLM	THM	CWL2M	CWH2M	BALSD
1	1	76.0	82.0	72.8	76.7	67.2	73.2	66.3	73.5	14.3
1	2	66.0	72.7	63.7	71.0	56.5	62.2	59.3	65.8	11.1
1	3	72.3	77.7	70.5	77.5	65.8	71.8	67.3	73.3	13.1
2	1	69.2	76.2	68.0	76.3	65.2	71.3	65.8	73.5	8.3
2	2	75.5	82.8	74.2	81.2	68.5	75.7	72.7	80.3	13.3
2	3	81.5	87.8	79.5	87.7	73.3	79.3	78.2	85.3	11.0

GROUP	TREAT	BAHSD	CWL1SD	CWH1SD	TLSD	THSD	CWL2SD	CWH2SD	BALMN
1	1	13.3	11.9	11.9	10.8	11.2	9.6	10.3	63.0
1	2	13.7	11.4	13.3	8.3	10.0	13.1	12.8	53.0
1	3	13.2	11.5	11.1	8.7	8.0	9.0	9.6	56.0
2	1	8.9	10.3	9.4	6.6	6.3	8.4	7.4	58.0
2	2	12.4	10.6	9.4	10.1	11.7	11.2	12.4	58.0
2	3	11.8	15.6	17.7	10.8	11.9	16.2	19.1	68.0

GROUP	TREAT	BAHMN	CWL1MN	CWH1MN	TLMN	THMN	CWL2MN	CWH2MN	BALMX
1	1	71.0	59.0	68.0	54.0	60.0	55.0	61.0	98.0
1	2	58.0	48.0	56.0	47.0	52.0	46.0	52.0	81.0
1	3	63.0	59.0	67.0	55.0	53.0	57.0	62.0	95.0
2	1	65.0	58.0	67.0	56.0	53.0	58.0	66.0	80.0
2	2	71.0	59.0	70.0	57.0	61.0	57.0	65.0	98.0
2	3	74.0	61.0	68.0	58.0	62.0	59.0	64.0	96.0

GROUP	TREAT	BAHMX	CWL1MX	CWL2MX	TLMX	THMX	CWL2MX	CWH2MX
1	1	103.0	87.0	92.0	82.0	89.0	81.0	86.0
1	2	93.0	82.0	95.0	70.0	80.0	83.0	88.0
1	3	101.0	91.0	96.0	81.0	86.0	79.0	87.0
2	1	90.0	82.0	91.0	72.0	80.0	77.0	84.0
2	2	105.0	89.0	97.0	85.0	93.0	88.0	98.0
2	3	104.0	100.0	110.0	85.0	93.0	97.0	108.0

Table 25

Cell means for each repeated heart rate variable (by Group*Time, Treat*Time, and Group*Treat*Time).

Group	Time	N	C	CH	BASEL	BASEH	TXL	TXH
1	1	18	69.000	75.056	71.444	77.444	63.167	69.055
1	2	18	64.333	70.889	71.444	77.444	63.167	69.055
2	1	18	73.889	81.722	75.389	82.278	69.000	75.444
2	2	18	72.222	79.722	75.389	82.278	69.000	75.444

Treat	Time	N	C	CH	BASEL	BASEH	TXL	TXH
1	1	12	70.417	76.500	72.583	79.083	66.167	72.250
1	2	12	66.083	73.500	72.583	79.083	66.167	72.250
2	1	12	68.917	76.083	70.750	77.750	62.500	68.917
2	2	12	66.000	73.083	70.750	77.750	62.500	68.917
3	1	12	75.000	82.583	76.917	82.750	69.583	75.583
3	2	12	72.750	79.333	76.917	82.750	69.583	75.583

Group	Treat	Time	N	C	CH	BASEL	BASEH	TXL	TXH
1	1	1	6	72.833	76.667	76.000	82.000	61.167	73.167
1	1	2	6	66.333	73.500	76.000	82.000	61.167	73.167
1	2	1	6	63.667	71.000	66.000	72.667	56.500	62.167
1	2	2	6	59.333	65.833	66.000	72.667	56.500	62.167
1	3	1	6	70.500	77.500	72.333	77.667	65.833	71.833
1	3	2	6	67.333	73.333	72.333	77.667	65.833	71.833
2	1	1	6	68.000	76.333	69.167	76.167	65.167	71.333
2	1	2	6	65.833	73.500	69.167	76.167	65.167	71.333
2	2	1	6	74.167	81.167	75.000	82.333	68.500	75.667
2	2	2	6	72.667	80.333	75.000	82.333	68.500	75.667
2	3	1	6	79.500	87.667	81.500	87.833	73.333	79.333
2	3	2	6	78.167	85.333	81.500	87.833	73.333	79.333

Table 26

Data set for all heart rate variables.

GROUP	TREAT	BASEL	BASEH	CPH1	TXL	TXH	CPH2	C	TIME	CPL1	CPL2	CH
1	1	65	72	68	54	60	67	81	1	81	59	68
1	1	65	72	68	54	60	67	59	2	81	59	67
1	1	63	71	70	64	69	69	66	1	66	64	70
1	1	63	71	70	64	69	69	64	2	66	64	69
1	1	98	103	92	82	89	86	82	1	82	74	92
1	1	98	103	92	82	89	86	74	2	82	74	86
1	1	87	92	92	77	83	86	87	1	87	81	92
1	1	87	92	92	77	83	86	81	2	87	81	86
1	1	78	83	70	68	74	72	62	1	62	65	70
1	1	78	83	70	68	74	72	65	2	62	65	72
1	1	65	71	68	58	64	61	59	1	59	55	68
1	1	65	71	68	58	64	61	55	2	59	55	61
1	2	81	93	95	70	80	88	82	1	82	83	95
1	2	81	93	95	70	80	88	83	2	82	83	88
1	2	66	71	70	58	64	67	65	1	65	58	70
1	2	66	71	70	58	64	67	58	2	65	58	67
1	2	53	58	56	47	52	52	48	1	48	46	56
1	2	53	58	56	47	52	52	46	2	48	46	52
1	2	77	84	75	61	64	71	69	1	69	64	75
1	2	77	84	75	61	64	71	64	2	69	64	71
1	2	62	70	65	53	59	59	59	1	59	52	65
1	2	62	70	65	53	59	59	52	2	59	52	59
1	2	57	60	65	50	54	58	59	1	59	53	65
1	2	57	60	65	50	54	58	53	2	59	53	58
1	3	65	70	67	62	67	66	62	1	62	60	67
1	3	65	70	67	62	67	66	60	2	62	60	66
1	3	56	63	70	55	63	62	59	1	59	57	70
1	3	56	63	70	55	63	62	57	2	59	57	62
1	3	76	83	85	62	69	87	74	1	74	77	85
1	3	76	83	85	62	69	87	77	2	74	77	87
1	3	95	101	96	81	86	82	91	1	91	79	96
1	3	95	101	96	81	86	82	79	2	91	79	82
1	3	73	76	70	68	75	74	66	1	66	68	70
1	3	73	76	70	68	75	74	68	2	66	68	74
1	3	69	73	77	67	71	69	71	1	71	63	77
1	3	69	73	77	67	71	69	63	2	71	63	69
2	1	63	70	68	65	70	71	58	1	58	59	68
2	1	63	70	68	65	70	71	59	2	58	59	71
2	1	58	65	73	56	63	67	62	1	62	59	73
2	1	58	65	73	56	63	67	59	2	62	59	67
2	1	77	82	75	67	73	72	68	1	68	68	75
2	1	77	82	75	67	73	72	68	2	68	68	72

2	1	69	74	84	72	76	81	79	1	79	74	84
2	1	69	74	84	72	76	81	74	2	79	74	81
2	1	68	76	67	59	66	66	59	1	59	58	67
2	1	68	76	67	59	66	66	58	2	59	58	66
2	1	80	90	91	72	80	84	82	1	82	77	91
2	1	80	90	91	72	80	84	77	2	82	77	84
2	2	68	72	75	57	61	65	70	1	70	57	75
2	2	68	72	75	57	61	65	57	2	70	57	65
2	2	79	87	82	72	80	88	76	1	76	78	82
2	2	79	87	82	72	80	88	78	2	76	78	88
2	2	58	71	70	59	64	68	59	1	59	63	70
2	2	58	71	70	59	64	68	63	2	59	63	68
2	2	74	80	78	67	77	79	69	1	69	72	78
2	2	74	80	78	67	77	79	72	2	69	72	79
2	2	98	105	97	85	93	98	89	1	89	88	97
2	2	98	105	97	85	93	98	88	2	89	88	98
2	2	76	82	85	71	79	84	82	1	82	78	85
2	2	76	82	85	71	79	84	78	2	82	78	84
2	3	75	79	83	69	73	79	78	1	78	75	83
2	3	75	79	83	69	73	79	75	2	78	75	79
2	3	96	104	103	85	93	108	90	1	90	97	103
2	3	96	104	103	85	93	108	97	2	90	97	108
2	3	68	74	68	58	62	64	61	1	61	59	68
2	3	68	74	68	58	62	64	59	2	61	59	64
2	3	89	96	94	78	86	89	86	1	86	80	94
2	3	89	96	94	78	86	89	80	2	86	80	89
2	3	73	80	68	66	73	66	62	1	62	62	68
2	3	73	80	68	66	73	66	62	2	62	62	66
2	3	88	94	110	84	89	106	100	1	100	96	110
2	3	88	94	110	84	89	106	96	2	100	96	106

Table 27

Descriptive statistics for the entire group.

VARIABLE	N	MEAN	STD DEV	MINIMUM	MAXIMUM
GROUP	36	1.500	0.507	1.000	2.000
TREAT	36	2.000	0.828	1.000	3.000
RELAX1	36	80.916	24.413	34.000	128.000
STAI1	36	15.750	4.662	6.000	24.000
CONFS1	36	2.777	1.045	1.000	4.000
CONFV1	36	87.750	42.952	0.000	145.000
VASI1	36	445.416	190.877	85.000	750.000
VASA1	36	418.361	204.791	60.000	750.000
TIME1	36	256.972	91.027	25.000	306.000
MONT	36	10.055	2.552	5.000	15.000
BLUNT	36	4.444	2.131	1.000	9.000
RELAX2	36	105.778	28.771	30.000	145.000
CONFS2	36	3.167	1.035	1.000	4.000
CONFV2	36	108.389	46.589	0.000	145.000
STAI2	36	11.139	5.144	5.000	28.000
EXPECT	36	25.028	6.497	11.000	38.000
VAS12	36	419.778	192.608	57.000	750.000
VASA2	36	373.444	196.763	77.000	750.000
TIME2	36	267.333	83.130	26.000	300.000

Table 28

Descriptive statistics for athletes (treat 1 = humor, 2 = relaxation, 3 = control).

GROUP=1 TREAT=1

VARIABLE	N	MEAN	STD DEV	MINIMUM	MAXIMUM
RELAX1	6	103.000	16.601	85.000	128.000
STAI1	6	13.333	5.007	8.000	21.000
CONFS1	6	3.500	0.548	3.000	4.000
CONFV1	6	111.000	21.503	82.000	132.000
VASI1	6	383.500	95.467	296.000	535.000
VASA1	6	323.833	104.949	186.000	509.000
TIME1	6	300.000	0.000	300.000	300.000
MONT	6	8.833	2.927	6.000	13.000
BLUNT	6	4.000	1.673	1.000	6.000
RELAX2	6	90.000	39.552	30.000	133.000
CONFS2	6	3.667	0.516	3.000	4.000
CONFV2	6	134.000	12.759	112.000	145.000
STAI2	6	9.333	2.065	7.000	13.000
EXPECT	6	29.000	7.536	18.000	38.000
VAS12	6	349.833	100.883	222.000	477.000
VASA2	6	284.544	109.859	146.000	440.000
TIME2	6	300.000	0.000	300.000	300.000

GROUP=1 TREAT=2

VARIABLE	N	MEAN	STD DEV	MINIMUM	MAXIMUM
RELAX1	6	83.000	21.251	56.000	115.000
STAI1	6	15.667	6.889	6.000	24.000
CONFS1	6	3.167	0.983	2.000	4.000
CONFV1	6	120.000	27.568	79.000	145.000
VASI1	6	463.167	216.772	193.000	715.000
VASA1	6	395.333	268.424	97.000	733.000
TIME1	6	242.667	90.568	100.000	300.000
MONT	6	9.833	2.787	5.000	13.000
BLUNT	6	5.167	2.714	1.000	9.000
RELAX2	6	99.667	32.414	58.000	132.000
CONFS2	6	3.333	1.211	1.000	4.000
CONFV2	6	109.667	48.841	21.000	145.000
STAI2	6	11.833	7.083	5.000	24.000
EXPECT	6	23.333	4.412	19.000	29.000
VAS12	6	502.333	172.426	254.000	706.000
VASA2	6	427.333	193.103	194.000	707.000
TIME2	6	300.000	0.000	300.000	300.000

GROUP=1 TREAT=3

VARIABLE	N	MEAN	STD DEV	MINIMUM	MAXIMUM
RELAX1	6	82.500	30.191	46.000	113.000
STAI1	6	14.667	3.724	10.000	20.000
CONFS1	6	3.667	0.516	3.000	4.000
CONFV1	6	121.500	20.734	85.000	144.000
VASI1	6	263.833	139.969	85.000	453.000
VASA1	6	226.333	104.179	60.000	336.000
TIME1	6	300.000	0.000	300.000	300.000
MONT	6	8.833	1.835	6.000	11.000
BLUNT	6	3.833	1.941	1.000	7.000
RELAX2	6	126.167	13.761	109.000	145.000
CONFS2	6	3.833	0.408	3.000	4.000
CONFV2	6	131.500	19.419	94.000	145.000
STAI2	6	8.500	1.516	7.000	11.000
EXPECT	6	27.667	4.546	19.000	31.000
VAS12	6	211.167	123.634	57.000	347.000
VASA2	6	180.000	78.567	77.000	279.000
TIME2	6	300.000	0.000	300.000	300.000

Table 29

Descriptive statistics for non-athletes (treat 1 = humor, 2 = relaxation, 3 = control).

GROUP=2 TREAT=1

VARIABLE	N	MEAN	STD DEV	MINIMUM	MAXIMUM
RELAX1	6	68.167	26.359	34.000	109.000
STAI1	6	16.500	4.549	9.000	21.000
CONFS1	6	2.667	0.816	2.000	4.000
CONFV1	6	81.833	38.426	41.000	133.000
VASI1	6	429.333	207.838	161.000	694.000
VASA1	6	424.667	165.581	197.000	624.000
TIME1	6	300.000	0.000	300.000	300.000
MONT	6	9.833	1.941	7.000	12.000
BLUNT	6	4.667	1.633	3.000	7.000
RELAX2	6	96.333	27.976	65.000	140.000
CONFS2	6	2.667	0.516	2.000	3.000
CONFV2	6	104.166	29.089	70.000	139.000
STAI2	6	12.000	5.404	5.000	18.000
EXPECT	6	22.333	8.359	11.000	34.000
VAS12	6	442.333	127.496	251.000	621.000
VASA2	6	398.333	101.097	234.000	511.000
TIME2	6	300.000	0.000	300.000	300.000

GROUP=2 TREAT=2

VARIABLE	N	MEAN	STD DEV	MINIMUM	MAXIMUM
RELAX1	6	67.333	17.040	49.000	95.000
STAI1	6	17.667	3.011	14.000	21.000
CONFS1	6	1.500	0.837	1.000	3.000
CONFV1	6	34.500	34.045	00.000	93.000
VASI1	6	548.667	147.575	413.000	750.000
VASA1	6	544.667	164.544	318.000	750.000
TIME1	6	218.333	127.932	25.000	300.000
MONT	6	11.000	2.757	8.000	15.000
BLUNT	6	3.333	2.422	1.000	7.000
RELAX2	6	115.333	27.926	64.000	144.000
CONFS2	6	2.667	1.367	1.000	4.000
CONFV2	6	84.167	63.464	00.000	141.000
STAI2	6	12.330	7.967	5.000	28.000
EXPECT	6	26.667	6.218	15.000	32.000
VAS12	6	450.667	229.688	257.000	750.000
VASA2	6	397.833	237.215	213.000	750.000
TIME2	6	220.167	125.587	26.000	300.000

GROUP=2 TREAT=3

VARIABLE	N	MEAN	STD DEV	MINIMUM	MAXIMUM
RELAX1	6	81.500	22.349	54.000	117.000
STAI1	6	16.667	4.633	11.000	24.000
CONFS1	6	2.167	0.753	1.000	3.000
CONFV1	6	57.667	31.039	15.000	94.000
VASI1	6	584.000	183.507	293.000	750.000
VASA1	6	595.500	180.651	311.000	750.000
TIME1	6	179.833	132.222	37.000	300.000
MONT	6	12.000	2.280	9.000	15.000
BLUNT	6	5.667	2.160	3.000	8.000
RELAX2	6	99.167	23.284	55.000	121.000
CONFS2	6	2.833	1.471	1.000	4.000
CONFV2	6	86.833	68.420	00.000	145.000
STAI2	6	12.833	4.119	8.000	20.000
EXPECT	6	21.167	5.419	16.000	28.000
VAS12	6	562.333	207.537	250.000	750.000
VASA2	6	552.667	226.061	224.000	750.000
TIME2	6	183.833	128.233	39.000	300.000

Appendix N

Pearson Moment Correlations

Table 30

Correlation matrix for the entire group.

	RELAX1	STAI1	CONFS1	CONFV1	VASI1	VASA1	TIME1	MONT
RELAX1	1.000	-0.658	0.482	-0.484	-0.204	-0.273	0.122	0.039
	0.0000	0.0001	0.0028	0.0002	0.2336	0.1072	0.4784	0.8231
STAI1	-0.658	1.000	-0.528	-0.481	0.340	0.517	-0.327	0.169
	0.0001	0.0000	0.0009	0.0030	0.0423	0.0012	0.0513	0.3235
CONFS1	0.482	-0.528	1.000	0.901	-0.535	-0.624	0.511	-0.274
	0.0029	0.0009	0.0000	0.0001	0.0008	0.0001	0.0014	0.1061
CONFV1	0.484	-0.481	0.901	1.000	-0.495	-0.571	0.352	-0.193
	0.0028	0.0030	0.0001	0.0000	0.0022	0.0003	0.0349	0.2600
VASI1	-0.204	0.340	-0.535	-0.495	1.000	0.865	-0.707	0.265
	0.2236	0.0423	0.0008	0.0022	0.0000	0.0001	0.0001	0.1179
VASA1	-0.273	0.517	-0.624	-0.571	0.865	1.000	-0.733	0.379
	0.1072	0.0012	0.0001	0.0003	0.0001	0.0000	0.0001	0.0225
TIME1	0.122	-0.327	0.511	0.352	-0.707	-0.733	1.000	-0.093
	0.4784	0.0513	0.0014	0.0349	0.0001	0.0001	0.0000	0.5891
MONT	0.039	0.167	-0.274	-0.193	0.265	0.379	-0.093	1.000
	0.8231	0.3235	0.1061	0.2600	0.1179	0.0225	0.5891	0.0000
BLUNT	-0.061	0.184	-0.108	-0.129	-0.005	0.023	0.050	0.111
	0.7247	0.2825	0.5293	0.4536	0.9768	0.3917	0.7701	0.5195
RELAX2	0.246	-0.575	0.266	0.234	-0.304	-0.413	0.288	0.008
	0.1479	0.0002	0.1165	0.1700	0.0715	0.0122	0.0883	0.9615
CONFS2	0.232	-0.392	0.527	0.493	-0.614	-0.651	0.728	-0.056
	0.1728	0.0181	0.0010	0.0022	0.0001	0.0001	0.0001	0.7431
CONFV2	0.261	-0.432	0.542	0.513	-0.633	-0.689	0.804	-0.012
	0.1244	0.0084	0.0006	0.0014	0.0001	0.0001	0.0001	0.9437
STAI2	-0.399	0.646	-0.355	-0.286	0.398	0.556	-0.449	0.082
	0.0158	0.0001	0.0334	0.0910	0.0162	0.0004	0.0060	0.6340
EXPECT	0.307	-0.331	0.186	0.217	-0.319	-0.341	0.327	0.055
	0.0686	0.0487	0.2271	0.2025	0.0581	0.0417	0.0514	0.7498
VASI2	-0.292	0.352	-0.446	-0.382	0.849	0.718	-0.679	0.143
	0.8538	0.0355	0.0064	0.0216	0.0001	0.0001	0.0001	0.4049
VASA2	-0.332	0.499	-0.523	-0.433	0.808	0.852	-0.781	0.182
	0.0480	0.0019	0.0011	0.0083	0.0001	0.0001	0.0001	0.2881
TIME2	0.112	-0.264	0.456	0.371	-0.611	-0.629	0.896	-0.050
	0.5145	0.1203	0.0051	0.0258	0.0001	0.0001	0.0001	0.7713

	BLUNT	RELAX2	CONFS2	CONFV2	STAI2	EXPECT	VASI2	VASA2	TIME2
RELAX1	-0.061	0.246	0.232	0.261	-0.399	0.307	-0.292	-0.331	0.112
	0.7247	0.1479	0.1728	0.1244	0.0153	0.0686	0.0838	0.0480	0.5145
STAI1	0.184	-0.575	-0.392	-0.432	0.646	-0.331	0.352	0.499	-0.264
	0.2825	0.0002	0.0181	0.0084	0.0001	0.0487	0.0355	0.0019	0.1203
CONFS1	-0.108	0.266	0.527	0.542	-0.355	0.186	-0.446	-0.523	0.456
	0.5293	0.1165	0.0010	0.0006	0.0334	0.2771	0.0064	0.0011	0.0051
CONFV1	-0.129	0.234	0.493	0.513	-0.286	0.217	-0.382	-0.433	0.371
	0.4536	0.1700	0.0022	0.0014	0.0910	0.2025	0.0216	0.0083	0.0258
VASI1	-0.005	-0.304	-0.614	-0.633	0.398	-0.319	0.849	0.808	-0.612
	0.9768	0.0715	0.0001	0.0001	0.0162	0.0581	0.0001	0.0001	0.0001
VASA1	0.023	-0.413	-0.651	-0.689	0.556	-0.341	0.717	0.352	-0.629
	0.8917	0.0122	0.0001	0.0001	0.0004	0.0417	0.0001	0.0001	0.0001
TIME1	0.050	0.288	0.728	0.904	-0.449	0.327	-0.679	-0.781	0.896
	0.7701	0.0883	0.0001	0.0001	0.0060	0.0514	0.0001	0.0001	0.0001
MONT	0.111	0.008	-0.056	-0.012	0.082	0.055	0.143	0.182	-0.050
	0.5195	0.9615	0.7431	0.9437	0.6340	0.7498	0.4049	0.2881	0.7713
BLUNT	1.000	-0.208	-0.095	-0.082	0.119	-0.108	0.026	0.115	0.149
	0.0000	0.2222	0.6234	0.6329	0.4882	0.5297	0.8813	0.5056	0.3863
RELAX2	-0.208	1.000	0.377	0.384	-0.739	0.404	-0.322	-0.461	0.199
	0.2222	0.0000	0.0236	0.0206	0.0001	0.0146	0.0558	0.0047	0.2443
CONFS2	-0.085	0.377	1.000	0.949	-0.462	0.412	-0.650	-0.734	0.659
	0.6234	0.0236	0.0000	0.0001	0.0041	0.0126	0.0001	0.0001	0.0001
CONFV2	-0.082	0.384	0.949	1.000	-0.542	0.447	-0.669	-0.762	0.730
	0.6329	0.0206	0.0001	0.0000	0.0006	0.0062	0.0001	0.0001	0.0001
STAI2	0.119	-0.739	-0.462	-0.542	1.000	-0.351	0.447	0.599	-0.426
	0.4882	0.0001	0.0046	0.0006	0.0000	0.0360	0.0041	0.0001	0.0095
EXPECT	-0.108	0.404	0.412	0.447	-0.351	1.000	-0.522	-0.556	0.354
	0.5297	0.0146	0.0126	0.0062	0.0360	0.0000	0.0011	0.0004	0.0341
VASI2	0.026	-0.322	-0.650	-0.669	0.467	-0.522	1.000	0.918	-0.661
	0.8813	0.0558	0.0001	0.0001	0.0041	0.0011	0.0000	0.0001	0.0001
VASA2	0.115	-0.461	-0.734	-0.762	0.599	-0.556	0.918	1.000	-0.721
	0.5056	0.0047	0.0001	0.0001	0.0001	0.0004	0.0001	0.0000	0.0001
TIME2	0.149	0.199	0.659	0.730	-0.426	0.354	-0.661	-0.721	1.000
	0.3863	0.2443	0.0001	0.0001	0.0095	0.0341	0.0001	0.0001	0.0000

Table 31

Correlation matrix for athletes in humor treatment.

	RELAX1	STAI1	CONFS1	CONFV1	VASI1	VASA1	TIME1	MONT
RELAX1	1.000	-0.820	0.682	0.839	0.091	-0.292	0.000	0.132
	0.0000	0.0454	0.1357	0.0367	0.8635	0.5747	1.0000	0.8036
STAI1	-0.820	1.000	-0.875	-0.973	-0.524	-0.078	0.000	-0.064
	0.0454	0.0000	0.0224	0.0010	0.2861	0.8834	1.0000	0.9046
CONFS1	0.682	-0.875	1.000	0.849	0.579	0.176	0.000	-0.187
	0.1357	0.0224	0.0000	0.0325	0.2281	0.7392	1.0000	0.7226
CONFV1	0.839	-0.973	0.849	1.000	0.589	0.101	0.000	0.184
	0.0367	0.0010	0.0325	0.0000	0.2181	0.8489	1.0000	0.7267
VASI1	0.091	-0.524	0.579	0.589	1.000	0.479	0.000	0.285
	0.8635	0.2861	0.2281	0.2181	0.0000	0.3359	1.0000	0.5838
VASA1	-0.292	-0.078	0.176	0.101	0.479	1.000	0.000	-0.459
	0.5747	0.8834	0.7392	0.8488	0.3359	0.0000	1.0000	0.3589
TIME1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
MONT	0.132	-0.064	-0.187	0.184	0.285	-0.459	0.000	1.000
	0.8036	0.9046	0.7226	0.7267	0.5838	0.3589	1.0000	0.0000
BLUNT	-0.655	0.668	-0.655	-0.728	-0.551	0.391	0.000	-0.572
	0.1579	0.1467	0.1583	0.1008	0.2573	0.4439	1.0000	0.2359
RELAX2	0.627	-0.945	0.794	0.930	0.724	0.194	0.000	0.212
	0.1829	0.0040	0.0593	0.0071	0.1035	0.7128	1.0000	0.6861
CONFS2	0.303	-0.645	0.707	0.468	0.279	0.128	0.000	-0.441
	0.5590	0.1670	0.1161	0.3489	0.5911	0.8091	1.0000	0.3813
CONFV2	0.451	-0.839	0.773	0.715	0.484	0.301	0.000	-0.268
	0.3690	0.0368	0.0716	0.1102	0.3310	0.5622	1.0000	0.6079
STAI2	-0.869	0.722	-0.707	-0.833	-0.360	0.027	0.000	-0.187
	0.0246	0.1052	0.1161	0.0395	0.4833	0.9594	1.0000	0.7221
EXPECT	0.270	-0.493	0.436	0.645	0.858	0.451	0.000	0.444
	0.6046	0.3205	0.3874	0.1663	0.0287	0.3698	1.0000	0.3774
VASI2	-0.127	-0.267	0.273	0.354	0.925	0.314	0.000	0.538
	0.8099	0.6088	0.6003	0.4913	0.0081	0.5449	1.0000	0.2705
VASA2	-0.707	0.413	-0.314	-0.337	0.378	0.805	0.000	-0.122
	0.1159	0.4152	0.5443	0.5137	0.4602	0.5131	1.0000	0.8167
TIME2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

	BLUNT	RELAX2	CONFS2	CONFV2	STAI2	EXPECT	VASI2	VASA2	TIME2
RELAX1	-0.655	0.627	0.303	0.451	-0.869	0.270	-0.127	-0.707	0.000
	0.1579	0.1829	0.5590	0.3690	0.0246	0.6046	0.8099	0.1159	0.1000
STAI1	0.668	-0.945	-0.645	-0.839	0.722	-0.493	-0.267	0.413	0.000
	0.1467	0.0044	0.1670	0.0368	0.1052	0.3205	0.6088	0.4152	1.0000
CONFS1	-0.655	0.794	0.707	0.773	-0.707	0.436	0.273	-0.314	0.000
	0.1583	0.0593	0.1161	0.0716	0.1161	0.3874	0.6003	0.5443	1.0000
CONFV1	-0.728	0.930	0.468	0.715	-0.833	0.645	0.353	-0.337	0.000
	0.1008	0.0071	0.3489	0.1102	0.0395	0.1663	0.4913	0.5137	1.0000
VASI1	-0.551	0.724	0.279	0.483	-0.360	0.858	0.925	0.378	0.000
	0.2573	0.1035	0.5911	0.3310	0.4833	0.0287	0.0081	0.4602	1.0000
VASA1	0.391	0.193	0.128	0.301	0.027	0.451	0.314	0.805	0.000
	0.4439	0.7128	0.8091	0.5622	0.9594	0.3698	0.5449	0.0531	1.0000
TIME1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
MONT	-0.571	0.212	-0.441	-0.268	-0.187	0.444	0.538	-0.122	0.000
	0.2359	0.6861	0.3813	0.6079	0.7221	0.3774	0.2705	0.8176	1.0000
BLUNT	1.000	-0.668	-0.231	-0.318	0.694	-0.523	0.508	0.494	0.000
	0.0000	0.1472	0.6590	0.5384	0.1258	0.2866	0.3033	0.3194	1.0000
RELAX2	-0.668	1.000	0.607	0.843	-0.585	0.641	0.535	-0.195	0.000
	0.1472	0.0000	0.2012	0.0351	0.2225	0.1704	0.2744	0.7107	1.0000
CONFS2	-0.231	0.607	1.000	0.912	-0.062	-0.103	0.037	-0.324	0.000
	0.6590	0.2012	0.0000	0.0116	0.9064	0.8464	0.9444	0.5306	1.0000
CONFV2	-0.318	0.843	0.911	1.000	-0.273	0.233	0.221	-0.204	0.000
	0.5384	0.0351	0.0116	0.0000	0.6004	0.6569	0.6742	0.6976	1.0000
STAI2	0.694	-0.585	-0.062	-0.273	1.000	-0.604	-0.146	0.357	0.000
	0.1258	0.2225	0.9064	0.6004	0.0000	0.2043	0.7818	0.4873	1.0000
EXPECT	-0.523	0.641	-0.103	0.233	-0.604	1.000	0.798	0.377	0.000
	0.2866	0.1704	0.8464	0.6569	0.2043	0.0000	0.0569	0.4615	1.0000
VASI2	-0.508	0.535	0.037	0.221	-0.146	0.798	1.000	0.441	0.000
	0.3033	0.2744	0.9444	0.6742	0.7818	0.0569	0.0000	0.3807	1.0000
VASA2	0.494	-0.195	-0.324	-0.204	0.357	0.377	0.441	1.000	0.000
	0.3194	0.7107	0.5306	0.6976	0.4873	0.4615	0.3807	0.0000	1.00000
TIME2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Table 32

Correlation matrix for athletes in relaxation treatment.

	RELAX1	STAI1	CONFS1	CONFV1	VASI1	VASA1	TIME1	MONT
RELAX1	1.000	-0.829	0.128	0.725	-0.194	-0.449	0.301	0.460
	0.0000	0.0414	0.3086	0.1030	0.7128	0.3710	0.5632	0.3583
STAI1	-0.829	1.000	0.139	-0.549	-0.255	-0.046	0.482	-0.771
	0.0414	0.0000	0.7933	0.2591	0.6295	0.9315	0.3326	0.0728
CONFS1	0.129	0.139	1.000	0.709	-0.513	-0.467	-0.632	-0.070
	0.8086	0.7933	0.0000	0.1114	0.2982	0.3502	0.1778	0.8946
CONFV1	0.725	-0.549	0.709	1.000	-0.217	-0.367	-0.035	0.407
	0.1030	0.2591	0.1141	0.0000	0.6796	0.4739	0.9469	0.4227
VASI1	-0.194	-0.255	-0.513	-0.217	1.000	0.954	0.662	0.589
	0.7128	0.6259	0.2982	0.6796	0.0000	0.0031	0.1520	0.2191
VASA1	-0.449	-0.046	-0.467	-0.367	0.954	1.000	0.474	0.445
	0.3710	0.9315	0.3502	0.4739	0.0031	0.0000	0.3421	0.3767
TIME1	0.300	-0.482	-0.632	-0.035	0.662	0.474	1.000	0.311
	0.5632	0.3326	0.1778	0.9469	0.1520	0.3421	0.000	0.5479
MONT	0.460	-0.771	-0.070	0.407	0.589	-0.445	0.311	1.000
	0.3583	0.0728	0.8946	0.4227	0.2191	0.3767	0.5479	0.0000
BLUNT	0.729	-0.729	0.532	0.912	-0.128	-0.247	0.042	0.496
	0.1004	0.1004	0.2771	0.0113	0.8087	0.6369	0.9369	0.3169
RELAX2	0.139	0.200	0.488	0.344	-0.680	-0.648	-0.184	-0.664
	0.7916	0.7035	0.3263	0.5046	0.1369	0.1643	0.7272	0.1503
CONFS2	0.462	-0.307	0.632	0.862	0.013	-0.117	0.200	0.222
	0.3558	0.5540	0.1778	0.0271	0.9799	0.8256	0.7040	0.6718
CONFV2	0.576	-0.389	0.718	0.948	-0.065	-0.214	0.038	0.379
	0.2319	0.4447	0.1081	0.0039	0.9026	0.6831	0.9433	0.4589
STAI2	-0.225	0.212	-0.255	-0.506	-0.167	-0.094	-0.584	0.036
	0.6683	0.6861	0.6253	0.3062	0.7515	0.8590	0.3301	0.9461
EXPECT	0.294	0.027	0.028	0.081	-0.672	-0.700	0.036	-0.655
	0.5712	0.9587	0.9574	0.8793	0.1434	0.1212	0.9461	0.1577
VASI2	-0.377	-0.071	-0.582	-0.436	0.953	0.956	0.495	0.503
	0.4614	0.8942	0.2259	0.3876	0.0032	0.0028	0.3185	0.3085
VASA2	-0.383	-0.068	-0.458	-0.333	0.966	0.976	0.467	0.528
	0.4537	0.8986	0.3605	0.5192	0.0017	0.0008	0.3497	0.2810
TIME2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

	BLUNT	RELAX2	CONFS2	CONFV2	STAI2	EXPECT	VASI2	VASA2	TIME2
RELAX1	0.729	0.139	0.462	0.576	-0.225	0.294	-0.377	-0.383	0.000
	0.1004	0.7916	0.3558	0.2319	0.6683	0.5712	0.4614	0.4537	1.0000
STAI1	-0.729	0.200	-0.307	-0.389	0.212	0.028	-0.071	-0.068	0.000
	0.1004	0.7035	0.5540	0.4447	0.6861	0.9587	0.8942	0.8986	1.0000
CONFS1	0.532	0.488	0.632	0.718	-0.255	0.028	-0.582	-0.458	0.000
	0.2771	0.3263	0.1778	0.1081	0.6253	0.9574	0.2259	0.3605	1.0000
CONFV1	0.912	0.344	0.862	0.948	-0.506	0.081	-0.436	-0.323	0.000
	0.0113	0.5046	0.0271	0.0039	0.3062	0.8793	0.3876	0.5192	1.0000
VASI1	-0.128	-0.680	0.013	-0.065	-0.167	-0.672	0.953	0.966	0.000
	0.8087	0.1369	0.9799	0.9026	0.7515	0.1432	0.0032	0.0017	1.0000
VASA1	-0.247	-0.648	-0.117	-0.214	-0.094	-0.700	0.956	0.976	0.000
	0.6369	0.1643	0.8256	0.6831	0.8590	0.1212	0.0028	0.0008	1.0000
TIME1	0.042	-0.184	0.200	0.038	-0.484	0.036	0.494	0.468	0.000
	0.9369	0.7972	0.7040	0.9433	0.3301	0.9461	0.3185	0.3497	1.0000
MONT	0.496	-0.664	0.222	0.379	0.036	-0.655	0.503	0.528	0.000
	0.3169	0.1503	0.6718	0.4589	0.9461	0.1577	0.3085	0.2810	1.0000
BLUNT	1.000	0.308	0.715	0.772	-0.509	0.128	-0.363	-0.274	0.000
	0.0000	0.5522	0.1101	0.0720	0.3017	0.8084	0.4791	0.5991	1.0000
RELAX2	0.308	1.000	0.433	0.282	-0.570	0.839	-0.813	-0.762	0.000
	0.5522	0.0000	0.3909	0.5885	0.2374	0.0369	0.0490	0.0784	1.0000
CONFS2	0.715	0.433	1.000	0.946	-0.807	0.072	-0.241	-0.112	0.000
	0.1101	0.3909	0.0000	0.0043	0.0520	0.8924	0.6454	0.8324	1.0000
CONFV2	0.772	0.282	0.946	1.000	-0.581	-0.061	-0.279	-0.159	0.000
	0.0720	0.5885	0.0043	0.0000	0.2269	0.9084	0.5920	0.7631	1.0000
STAI2	-0.509	-0.570	-0.807	-0.581	1.000	-0.319	0.108	0.005	0.000
	0.3017	0.2374	0.0520	0.2269	0.0000	0.5376	0.8382	0.9924	1.0000
EXPECT	0.128	0.839	0.072	-0.061	-0.319	1.000	-0.762	-0.797	0.000
	0.8084	0.0369	0.8924	0.9084	0.5376	0.0000	0.0779	0.0574	1.0000
VASI2	-0.363	-0.813	-0.241	-0.279	0.108	-0.762	1.000	0.987	0.000
	0.4791	0.0490	0.6454	0.5920	0.8382	0.0779	0.0000	0.0002	1.0000
VASA2	-0.274	-0.762	-0.112	-0.159	0.005	0.787	0.987	1.000	0.000
	0.5991	0.0784	0.8324	0.7631	0.9924	0.0574	0.0002	0.0000	1.0000
TIME2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Table 33

Correlation matrix for athletes in control group.

	RELAX1	STAI1	CONFS1	CONFV1	VASI1	VASA1	TIME1	MONT
RELAX1	1.000	-0.901	0.517	0.644	-0.320	-0.436	0.238	-0.267
	0.0000	0.0141	0.2937	0.1677	0.5361	0.3868	0.6501	0.6093
STAI1	-0.901	1.000	-0.699	-0.740	0.423	0.707	-0.378	0.590
	0.0141	0.0000	0.1224	0.0924	0.4031	0.1159	0.4603	0.2174
CONFS1	0.5169	-0.699	1.000	0.974	-0.753	-0.963	0.901	-0.572
	0.2937	0.1224	0.0000	0.0010	0.0841	0.0020	0.0141	0.2358
CONFV1	0.644	-0.740	0.974	1.000	-0.688	-0.904	0.857	-0.510
	0.1677	0.0924	0.0010	0.0000	0.1306	0.0133	0.0290	0.3011
VASI1	-0.320	0.423	-0.753	-0.688	1.000	0.629	-0.761	0.005
	0.5361	0.4031	0.0841	0.1306	0.0000	0.1811	0.0790	0.9930
VASA1	-0.436	0.707	-0.963	-0.904	0.629	1.000	-0.825	0.756
	0.3868	0.1159	0.0020	0.0133	0.1811	0.0000	0.0431	0.0819
TIME1	0.238	-0.378	0.901	0.857	-0.761	-0.825	1.000	-0.362
	0.6501	0.4603	0.0141	0.0290	0.0790	0.0431	0.000	0.4802
MONT	-0.267	0.590	-0.572	-0.510	0.004	0.756	-0.362	1.000
	0.6093	0.2174	0.2358	0.3011	0.9930	0.0819	0.4802	0.0000
BLUNT	-0.901	0.656	-0.387	-0.551	0.353	0.211	-0.259	-0.101
	0.0141	0.1572	0.4482	0.2575	0.4919	0.6886	0.6198	0.8485
RELAX2	0.449	-0.782	0.705	0.608	-0.427	-0.830	0.486	-0.829
	0.3709	0.0659	0.1177	0.1999	0.3987	0.0407	0.3278	0.0415
CONFS2	0.567	-0.487	0.784	0.880	-0.578	-0.628	0.734	-0.158
	0.2403	0.3268	0.0650	0.020	0.2298	0.1819	0.0966	0.7649
CONFV2	0.648	-0.649	0.888	0.959	-0.633	-0.773	0.773	-0.338
	0.1639	0.1628	0.0180	0.0025	0.1775	0.0712	0.0713	0.5177
STAI2	-0.648	0.892	-0.541	-0.501	0.223	0.666	-0.187	0.778
	0.1637	0.0168	0.2678	0.3024	0.6710	0.1482	0.7221	0.0682
EXPECT	0.787	-0.588	-0.107	0.046	0.215	0.139	-0.399	-0.011
	0.0632	0.2199	0.8393	0.9310	0.6823	0.7923	0.4332	0.7837
VASI2	-0.797	0.681	-0.365	-0.452	0.527	0.236	-0.088	-0.124
	0.0575	0.1360	0.4769	0.3676	0.2827	0.6529	0.8685	0.8151
VASA2	-0.895	0.943	-0.813	-0.882	0.524	0.766	-0.531	0.511
	0.0160	0.0048	0.0489	0.0200	0.2864	0.0754	0.2787	0.3005
TIME2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

	BLUNT	RELAX2	CONFS2	CONFV2	STAI2	EXPECT	VASI2	VASA2	TIME2
RELAX1	-0.901	0.449	0.567	0.648	-0.648	0.787	-0.797	-0.845	0.000
	0.0141	0.3709	0.2403	0.1639	0.1637	0.0632	0.0575	0.0160	1.0000
STAI1	0.656	-0.782	-0.487	-0.649	0.892	-0.588	0.681	0.943	0.000
	0.1572	0.0659	0.3268	0.1628	0.0168	0.2199	0.1360	0.0048	1.0000
CONFS1	-0.387	0.705	0.784	0.888	-0.541	-0.107	-0.365	0.049	0.000
	0.4482	0.1177	0.0650	0.0180	0.2678	0.8393	0.4769	0.0489	1.0000
CONFV1	-0.551	0.608	0.880	0.959	-0.509	0.046	-0.452	-0.882	0.000
	0.2575	0.1999	0.0205	0.0025	0.3024	0.9310	0.3676	0.0200	1.0000
VASI1	0.353	-0.427	-0.578	-0.633	0.223	0.215	0.527	0.524	0.000
	0.4919	0.3987	0.2298	0.1775	0.6710	0.6823	0.2827	0.2864	1.0000
VASA1	0.211	-0.830	-0.628	-0.773	0.666	0.139	0.236	0.766	0.000
	0.6886	0.0407	0.1819	0.0702	0.1482	0.7923	0.6529	0.0754	1.0000
TIME1	-0.259	0.486	0.734	0.773	-0.187	-0.399	-0.088	-0.531	0.000
	0.6198	0.3278	0.0966	0.0713	0.7221	0.4332	0.8685	0.2787	1.0000
MONT	-0.101	-0.829	-0.158	-0.338	0.778	-0.011	-0.124	0.511	0.000
	0.8495	0.0415	0.7649	0.5117	0.0682	0.9837	0.8151	0.3005	1.0000
BLUNT	1.000	-0.115	-0.629	-0.618	0.272	-0.707	0.756	0.717	0.000
	0.0000	0.8280	0.1812	0.1909	0.6017	0.1162	0.0819	0.1069	1.0000
RELAX2	-0.115	1.000	0.166	0.385	-0.905	0.099	-0.218	-0.647	0.000
	0.8280	0.0000	0.7527	0.4509	0.0130	0.8522	0.6786	0.1646	1.0000
CONFS2	-0.629	0.166	1.000	0.973	-0.132	0.049	-0.478	-0.744	0.000
	0.1812	0.7527	0.0000	0.0011	0.8030	0.9252	0.3381	0.0901	1.0000
CONFV2	-0.618	0.385	0.973	1.000	-0.349	0.093	-0.526	-0.858	0.000
	0.1909	0.4509	0.0011	0.0000	0.4980	0.8603	0.2832	0.0288	1.0000
STAI2	0.272	-0.905	-0.132	-0.349	1.000	-0.459	0.434	0.737	0.000
	0.6017	0.0130	0.8030	0.4980	0.0000	0.3603	0.3902	0.0948	1.0000
EXPECT	-0.707	0.099	0.049	0.093	-0.459	1.000	-0.634	-0.474	0.000
	0.1162	0.8522	0.9252	0.8603	0.3603	0.0000	0.1738	0.3419	1.0000
VASI2	0.756	-0.218	-0.478	-0.526	0.434	-0.637	1.000	0.717	0.000
	0.0819	0.6786	0.3381	0.2832	0.3902	0.1738	0.0000	0.1086	1.0000
VASA2	0.717	-0.647	-0.744	-0.858	0.737	-0.474	0.717	1.000	0.000
	0.1089	0.1646	0.0901	0.0288	0.0948	0.3419	0.1086	0.0000	1.0000
TIME2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Table 34

Correlation matrix for non-athletes in humor treatment.

	RELAX1	STAI1	CONFS1	CONFV1	VASI1	VASA1	TIME1	MONT
RELAX1	1.000	-0.830	0.621	0.735	-0.162	-0.185	0.000	0.385
	0.0000	0.0409	0.1882	0.0961	0.7593	0.7250	1.0004	0.4513
STAI1	-0.830	1.000	-0.646	-0.773	0.474	0.517	0.000	0.102
	0.0409	0.0000	0.1657	0.0716	0.3425	0.2931	1.0000	0.8476
CONFS1	0.621	-0.646	1.000	0.705	-0.017	0.045	0.000	-0.294
	0.1882	0.1657	0.0000	0.1174	0.9747	0.9327	1.0000	0.5710
CONFV1	0.735	-0.773	0.705	1.000	-0.622	-0.566	0.000	0.075
	0.0916	0.0716	0.1174	0.0000	0.1876	0.2420	1.0000	0.8882
VASI1	-0.162	0.474	-0.017	-0.622	1.000	0.983	0.000	0.098
	0.7593	0.3425	0.9747	0.1876	0.0000	0.0004	1.0000	0.8530
VASA1	-0.185	0.517	0.045	-0.566	0.983	1.000	0.000	0.086
	0.7250	0.2931	0.9327	0.2420	0.0004	0.0000	1.0000	0.8718
TIME1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
MONT	0.385	0.102	-0.294	0.075	0.098	0.086	0.000	1.000
	0.4513	0.8476	0.5710	0.8882	0.8530	0.8718	1.0000	0.0000
BLUNT	-0.662	0.404	-0.400	-0.441	-0.127	-0.074	0.000	-0.463
	0.1516	0.4272	0.4320	0.3815	0.8098	0.8896	1.0000	0.3554
RELAX2	0.499	-0.426	-0.283	0.343	-0.523	-0.613	0.000	0.631
	0.3140	0.3999	0.5867	0.5058	0.2867	0.1958	1.0000	0.1790
CONFS2	-0.185	0.085	-0.790	-0.235	-0.425	-0.535	0.000	0.333
	0.7261	0.8726	0.0612	0.6537	0.4003	0.2742	1.0000	0.5195
CONFV2	0.418	-0.144	-0.427	0.121	-0.225	-0.298	0.000	0.868
	0.4095	0.7850	0.3989	0.8189	0.6678	0.5661	1.0000	0.0248
STAI2	-0.564	0.390	0.227	-0.242	0.244	0.358	0.000	-0.706
	0.2433	0.4441	0.6658	0.6444	0.6413	0.4861	1.0000	0.1172
EXPECT	0.249	-0.352	-0.391	-0.099	-0.277	-0.387	0.000	0.201
	0.6339	0.4933	0.4437	0.8514	0.5952	0.4484	1.0000	0.7020
VASI2	-0.354	0.607	-0.214	-0.767	0.966	0.930	0.000	0.056
	0.4913	0.2011	0.6840	0.0748	0.0017	0.0072	1.0000	0.9160
VASA2	-0.319	0.594	0.043	-0.586	0.951	0.981	0.000	-0.037
	0.5368	0.2138	0.9358	0.2214	0.0035	0.0005	1.0000	0.9440
TIME2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

	BLUNT	RELAX2	CONFS2	CONFV2	STAI2	EXPECT	VASI2	VASA2	TIME2
RELAX1	-0.662	0.499	-0.185	0.418	-0.564	0.249	-0.354	-0.319	0.000
	0.1516	0.3140	0.7261	0.4095	0.2433	0.6339	0.4913	0.5368	1.0000
STAI1	0.404	-0.426	0.085	-0.144	0.390	-0.352	0.607	0.594	0.000
	0.4272	0.3999	0.8726	0.7850	0.4441	0.4933	0.2011	0.2138	1.0000
CONFS1	-0.400	-0.283	-0.790	-0.427	0.227	-0.391	-0.214	0.043	0.000
	0.4320	0.5867	0.0612	0.3989	0.6658	0.4437	0.6840	0.9358	1.0000
CONFV1	-0.441	0.343	-0.235	0.121	-0.242	-0.099	-0.767	-0.586	0.000
	0.3815	0.5058	0.6537	0.8189	0.6444	0.8514	0.0748	0.2214	1.0000
VASI1	-0.127	-0.523	-0.425	-0.225	0.244	-0.277	0.966	0.951	0.000
	0.8098	0.2867	0.4003	0.6678	0.6413	0.5952	0.0017	0.0035	1.0000
VASA1	-0.074	-0.613	-0.535	-0.298	0.358	-0.387	0.930	0.981	0.000
	0.8896	0.1958	0.2742	0.5661	0.4861	0.4484	0.0072	0.0005	1.0000
TIME1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
MONT	-0.463	0.631	0.333	0.868	-0.706	0.201	0.056	-0.037	0.000
	0.3554	0.1790	0.5195	0.0248	0.1172	0.7020	0.9160	0.9440	1.0000
BLUNT	1.000	-0.395	0.079	-0.377	0.612	0.215	-0.063	-0.015	0.000
	0.0000	0.4377	0.8817	0.4606	0.1967	0.6826	0.9060	0.9776	1.0000
RELAX2	-0.395	1.000	0.743	0.915	-0.942	0.634	-0.498	-0.720	0.000
	0.4377	0.0000	0.0906	0.0106	0.0050	0.1764	0.3143	0.1062	1.0000
CONFS2	0.079	0.743	1.000	0.683	-0.645	0.633	-0.247	-0.564	0.000
	0.8817	0.0906	0.0000	0.1344	0.1666	0.1771	0.6369	0.2433	1.0000
CONFV2	-0.377	0.915	0.683	1.000	-0.915	0.575	-0.214	-0.430	0.000
	0.4606	0.0106	0.1344	0.0000	0.0106	0.2329	0.6833	0.3943	1.0000
STAI2	0.612	-0.942	-0.645	-0.915	1.000	-0.544	0.229	0.482	0.000
	0.1967	0.0050	0.1666	0.0106	0.0000	0.2638	0.6620	0.3328	1.0000
EXPECT	0.215	0.634	0.633	0.575	-0.544	1.000	-0.264	-0.516	0.000
	0.6826	0.1764	0.1771	0.2329	0.2638	0.0000	0.6132	0.2946	1.0000
VASI2	-0.063	-0.498	-0.247	-0.214	0.229	-0.264	1.000	0.924	0.000
	0.9060	0.3143	0.6369	0.6833	0.6620	0.6132	0.0000	0.0084	1.0000
VASA2	-0.015	-0.720	-0.564	-0.430	0.482	-0.516	0.924	1.000	0.000
	0.9776	0.1062	0.2433	0.3943	0.3328	0.2946	0.0084	0.0000	1.0000
TIME2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Table 35

Correlation matrix for non-athletes in relaxation group.

	RELAX1	STAI1	CONFS1	CONFV1	VASI1	VASA1	TIME1	MONT
RELAX1	1.000	-0.094	0.134	-0.039	0.412	0.578	-0.296	0.122
	0.0000	0.0859	0.8002	0.9402	0.4183	0.2292	0.5685	0.8179
STAI1	-0.943	1.000	-0.159	0.516	0.150	0.423	-0.066	0.289
	0.8589	0.0000	0.7638	0.2947	0.7760	0.4026	0.9002	0.5784
CONFS1	0.134	0.159	1.000	0.891	-0.526	-0.244	0.458	0.433
	0.8002	0.7638	0.0000	0.0171	0.2833	0.6412	0.3613	0.3904
CONFV1	-0.039	0.516	0.891	1.000	-0.394	-0.035	0.301	0.285
	0.9402	0.2947	0.0171	0.0000	0.4394	0.9472	0.5616	0.5838
VASI1	0.411	0.150	-0.526	-0.394	1.000	0.874	-0.954	-0.499
	0.4183	0.7760	0.2833	0.4394	0.0000	0.0229	0.0031	0.3137
VASA1	0.578	0.423	-0.244	-0.035	0.874	1.000	-0.829	-0.361
	0.2292	0.4026	0.6412	0.9472	0.0229	0.0000	0.0412	0.4813
TIME1	-0.296	-0.066	0.458	0.301	-0.954	-0.829	1.000	0.712
	0.5685	0.9002	0.3613	0.5616	0.0031	0.0412	0.0000	0.1127
MONT	0.122	0.289	0.433	0.285	-0.499	-0.361	0.712	1.000
	0.8179	0.5784	0.3904	0.5838	0.3137	0.4813	0.1127	0.0000
BLUNT	-0.350	-0.119	-0.395	-0.484	-0.429	-0.582	0.599	0.509
	0.4961	0.8226	0.4386	0.3304	0.3949	0.2258	0.2088	0.3022
RELAX2	0.555	-0.531	0.137	-0.176	-0.372	-0.247	0.445	0.311
	0.2531	0.2782	0.7958	0.7380	0.4676	0.6370	0.3763	0.5475
CONFS2	-0.347	0.065	0.525	0.484	-0.959	-0.721	0.934	0.531
	0.4999	0.9029	0.2850	0.3306	0.0024	0.1058	0.0063	0.2784
CONFV2	-0.449	0.023	0.503	0.437	-0.982	-0.817	0.962	0.562
	0.3721	0.9649	0.3093	0.3858	0.0005	0.0471	0.0022	0.2453
STAI2	-0.413	0.672	-0.150	0.244	0.461	0.459	-0.536	-0.382
	0.4154	0.1433	0.7766	0.6408	0.3573	0.3598	0.2729	0.4543
EXPECT	-0.538	0.548	0.422	0.541	-0.690	-0.518	0.746	0.677
	0.2710	0.2599	0.4035	0.2679	0.1290	0.2919	0.0887	0.1399
VAS12	0.275	-0.145	-0.491	-0.409	0.909	0.712	-0.976	-0.769
	0.5977	0.7843	0.3224	0.4119	0.0118	0.1125	1.0008	0.0736
VASA2	0.285	0.054	-0.504	-0.331	0.940	0.830	-0.994	-0.754
	0.5845	0.9192	0.3076	0.5215	0.0052	0.0408	0.0001	0.0830
TIME2	-0.278	-0.085	0.456	0.290	-0.952	-0.829	0.999	0.712
	0.5937	0.8721	0.3636	0.5770	0.0034	0.0414	0.0001	0.1127

	BLUNT	RELAX2	CONFS2	CONFV2	STAI2	EXPECT	VASI2	VASA2	TIME2
RELAX1	-0.350	0.555	-0.347	-0.449	-0.413	-0.538	0.275	0.285	-0.278
	0.4961	0.2531	0.4999	0.3721	0.4145	0.2710	0.5977	0.5845	0.5937
STAI1	-0.119	-0.531	0.065	0.023	0.672	0.548	-0.145	0.054	-0.085
	0.8226	0.2782	0.9029	0.9649	0.1433	0.2599	0.7843	0.9192	0.8721
CONFS1	-0.395	0.137	0.525	0.503	-0.150	0.423	-0.491	-0.504	0.456
	0.4386	0.7958	0.2850	0.3093	0.7766	0.4035	0.3224	0.3076	0.3636
CONFV1	-0.484	-0.176	0.484	0.437	0.244	0.541	-0.409	-0.331	0.290
	0.3304	0.7380	0.3306	0.3858	0.6408	0.2679	0.4199	0.5215	0.5770
VASI1	-0.429	-0.372	-0.959	-0.982	0.461	-0.690	0.909	0.940	-0.952
	0.3949	0.4676	0.0024	0.0005	0.3573	0.1290	0.0118	0.0052	0.0034
VASA1	-0.582	-0.247	-0.721	-0.817	0.459	-0.518	0.712	0.830	-0.829
	0.2258	0.6370	0.1058	0.0471	0.3598	0.2919	0.1125	0.0408	0.0414
TIME1	0.599	0.445	0.934	0.962	-0.536	0.746	-0.976	-0.994	0.999
	0.2088	0.3763	0.0063	0.0022	0.2729	0.0887	0.0008	0.0001	0.0001
MONT	0.509	0.312	0.531	0.562	-0.382	0.677	-0.769	-0.744	0.712
	0.3022	0.5475	0.2784	0.2453	0.4543	0.1399	0.0736	0.0830	0.1127
BLUNT	1.000	0.276	0.403	0.473	-0.390	0.434	-0.561	-0.576	0.600
	0.0000	0.5966	0.4283	0.3432	0.4441	0.3901	0.2468	0.2312	0.2079
RELAX2	0.276	1.000	0.365	0.292	-0.948	-0.183	-0.365	-0.409	0.467
	0.5966	0.0000	0.4766	0.5743	0.0040	0.7278	0.4770	0.4197	0.3505
CONFS2	0.403	0.365	1.000	0.983	-0.374	0.761	-0.944	-0.907	0.930
	0.4283	0.4766	0.0000	0.0004	0.4656	0.0788	0.0046	0.0125	0.0071
CONFV2	0.473	0.292	0.983	1.000	-0.356	0.801	0.954	-0.946	0.957
	0.3432	0.5743	0.0004	0.0000	0.4878	0.0555	0.0031	0.0043	0.0028
STAI2	-0.390	-0.948	-0.374	-0.356	1.000	0.132	0.412	0.521	-0.557
	0.4441	0.0040	0.4656	0.4878	0.0000	0.8033	0.4165	0.2889	0.2503
EXPECT	0.434	-0.183	0.761	0.801	0.132	1.000	-0.840	-0.759	0.729
	0.3901	0.7278	0.0788	0.0555	0.8033	0.0000	0.0364	0.40800	0.0999
VASI2	-0.561	-0.365	-0.944	-0.954	0.412	-0.840	1.000	0.970	-0.973
	0.2468	0.4770	0.0046	0.0031	0.4165	0.0364	0.0000	0.0013	0.0011
VASA2	-0.576	-0.409	-0.907	-0.946	0.521	-0.759	0.970	1.000	-0.993
	0.2312	0.4197	0.0125	0.0043	0.2889	0.0800	0.0013	0.0000	0.0000
TIME2	0.600	0.467	0.930	0.957	-0.557	0.729	-0.973	-0.993	1.000
	0.2079	0.3505	0.0071	0.0028	0.2503	0.0999	0.0011	0.0001	0.0000

Table 36

Correlation matrix for non-athletes in control group.

	RELAX1	STAI1	CONFS1	CONFV1	VASI1	VASA1	TIME1	MONT
RELAX1	1.000	-0.168	0.458	-0.005	-0.341	-0.264	0.335	0.408
	0.0000	0.7503	0.3614	0.9914	0.5079	0.6135	0.5167	0.4218
STAI1	-0.168	1.000	-0.612	-0.182	0.667	0.703	-0.638	-0.341
	0.7503	0.0000	0.1969	0.7304	0.1480	0.1189	0.1725	0.5087
CONFS1	0.458	-0.612	1.000	0.739	0.114	-0.121	0.245	0.932
	0.3614	0.1969	0.0000	0.0933	0.8292	0.8189	0.6392	0.0068
CONFV1	-0.006	-0.182	0.739	1.000	0.322	0.306	-0.269	0.771
	0.9914	0.7304	0.0933	0.0000	0.5330	0.5548	0.6063	0.0724
VASI1	-0.341	0.667	-0.114	0.322	1.000	0.995	-0.896	0.088
	0.5079	0.1480	0.8292	0.5330	0.0000	0.0001	0.0158	0.8677
VASA1	-0.264	0.703	-0.121	0.306	0.995	1.000	-0.909	0.081
	0.6135	0.1189	0.8189	0.5548	0.0001	0.0000	0.0119	0.8786
TIME1	0.335	-0.638	0.245	-0.269	-0.896	-0.909	1.000	0.155
	0.5167	0.1725	0.6392	0.6063	0.0158	0.0119	0.000	0.7690
MONT	0.408	-0.341	0.932	0.771	0.088	0.081	0.155	1.000
	0.4218	0.5087	0.0068	0.0724	0.8677	0.8786	0.7690	1.0000
BLUNT	0.928	-0.293	0.409	-0.041	-0.367	-0.289	0.224	0.244
	0.0076	0.5730	0.4195	0.9389	0.4745	0.5778	0.6689	0.6418
RELAX2	-0.034	-0.856	0.717	0.430	-0.423	-0.488	0.588	0.603
	0.9484	0.0297	0.1088	0.3943	0.4036	0.3266	0.2199	0.2045
CONFS2	-0.015	-0.508	0.210	0.068	-0.754	-0.786	0.818	0.179
	0.9772	0.3032	0.6888	0.8973	0.0835	0.0636	0.0468	0.7347
CONFV2	-0.009	-0.488	0.234	0.111	-0.726	-0.758	0.798	0.214
	0.9860	0.3255	0.6559	0.8346	0.1019	0.0805	0.0569	0.6838
STAI2	0.097	0.866	-0.441	-0.219	0.722	0.776	-0.719	-0.255
	0.8554	0.0256	0.3817	0.6760	0.1049	0.0697	0.1073	0.6251
EXPECT	0.655	-0.531	0.433	0.150	-0.758	-0.711	0.564	0.243
	0.1582	0.2783	0.3910	0.7764	0.0806	0.1135	0.2433	0.6430
VASI2	-0.477	0.626	-0.183	0.257	0.985	0.965	-0.871	0.008
	0.3391	0.1833	0.7279	0.6233	0.0003	0.0018	0.0240	0.9873
VASA2	-0.473	0.624	-0.200	0.235	0.983	0.964	-0.884	0.020
	0.3432	0.1852	0.7032	0.6543	0.0004	0.0019	0.0193	0.9697
TIME2	0.348	-0.625	0.228	-0.297	-0.895	-0.907	0.999	0.139
	0.4989	0.1644	0.6636	0.5678	0.0159	0.0125	0.0001	0.7931

	BLUNT	RELAX2	CONFS2	CONFV2	STAI2	EXPECT	VASI2	VASA2	TIME2
RELAX1	0.928	-0.034	-0.015	-0.009	0.097	0.655	-0.477	-0.473	0.348
	0.0076	0.9484	0.9772	0.9860	0.8554	0.1582	0.3391	0.3432	0.4989
STAI1	-0.293	-0.856	-0.508	-0.488	0.866	-0.531	0.626	0.624	-0.625
	0.5730	0.0297	0.3032	0.3255	0.0256	0.2783	0.1883	0.1852	0.1844
CONFS1	0.409	0.717	0.210	0.233	-0.441	0.433	-0.183	-0.200	0.228
	0.4195	0.1088	0.6888	0.6559	0.3817	0.3910	0.7279	0.7032	0.6636
CONFV1	-0.041	0.043	0.068	0.111	-0.219	0.150	0.257	0.235	-0.297
	0.9389	0.3943	0.8973	0.8346	0.6760	0.7764	0.6233	0.6543	0.5678
VASI1	-0.367	-0.423	-0.754	-0.726	0.722	-0.758	0.985	0.983	-0.895
	0.4745	0.4036	0.0835	0.1019	0.1049	0.0806	0.0003	0.0004	0.0159
VASA1	-0.289	-0.487	-0.786	-0.758	0.776	-0.711	0.965	0.964	-0.907
	0.5778	0.3226	0.0636	0.0805	0.0697	0.1135	0.0018	0.0019	0.0125
TIME1	0.224	0.588	0.818	0.798	-0.719	0.564	-0.871	-0.884	0.999
	0.6689	0.2199	0.0468	0.0569	0.1073	0.2433	0.0240	0.0193	0.0001
MONT	0.244	0.603	0.179	0.214	-0.255	0.243	0.008	-0.020	0.139
	0.6418	0.2054	0.7347	0.6838	0.6251	0.6430	0.9873	0.9697	0.7931
BLUNT	1.000	-0.058	-0.147	-0.152	0.059	0.689	-0.485	-0.466	0.238
	0.0000	0.9126	0.7814	0.7738	0.9102	0.1300	0.3295	0.3512	0.6497
RELAX2	-0.058	1.000	0.614	0.613	-0.867	0.274	-0.373	-0.393	0.566
	0.9126	0.0000	0.1950	0.1958	0.0253	0.5994	0.4666	0.4410	0.2416
CONFS2	-0.147	0.614	1.000	0.998	-0.830	0.531	-0.724	-0.751	0.801
	0.7814	0.1950	0.0000	0.0001	0.0408	0.2787	0.1034	0.0853	0.0555
CONFV2	-0.152	0.613	0.998	1.000	-0.818	0.530	-0.703	-0.731	0.780
	0.7738	0.1958	0.0001	0.0000	0.0465	0.2791	0.1191	0.0987	0.0670
STAI2	0.059	-0.867	-0.830	-0.818	1.000	-0.509	0.662	0.675	-0.697
	0.9102	0.0253	0.0408	0.0465	0.0000	0.3022	0.1519	0.1413	0.1234
EXPECT	0.689	0.274	0.531	0.530	-0.509	1.000	-0.847	-0.846	0.558
	0.1300	0.5994	0.2787	0.2791	0.3022	0.0000	0.0331	0.0337	0.2495
VASI2	-0.485	-0.373	-0.724	-0.703	0.662	-0.847	1.000	0.999	-0.871
	0.3295	0.4666	0.1034	0.1191	0.1519	0.0331	0.0000	0.0001	0.0239
VASA2	-0.466	-0.393	-0.751	-0.731	0.675	-0.846	0.999	1.000	-0.884
	0.3512	0.4410	0.0853	0.0987	0.1413	0.0337	0.0001	0.0000	0.0195
TIME2	0.238	0.566	0.801	0.780	-0.697	0.558	-0.871	-0.884	1.000
	0.6497	0.2416	0.0555	0.0670	0.1234	0.2495	0.0239	0.0195	0.0000

Vita

Simon Davies was born on November 4, 1955 in Farnborough, England. After graduating from St. Bartholomew's Grammar School, he began undergraduate studies at Birmingham University, England, from where he graduated with a combined honors B.A. in sport science and geography. Post-graduate studies followed at Madeley College, where he obtained a teaching diploma in physical education and history. After working in the private sector for two years, he entered the master's program in human kinetics at Windsor University, Canada. Completing his studies in two and one half years, he returned to work in London, before entering Louisiana State University, where he obtained an M.A. in counseling and a Ph.D in sport psychology.

DOCTORAL EXAMINATION AND DISSERTATION REPORT

Candidate: Simon Davies

Major Field: Physical Education (Sport Psychology)

Title of Dissertation: The Effects of Relaxation and Laughter on the Perceived Intensity and Affect of Pain Tolerance

Approved:

Amelia M. Lee
Major Professor and Chairman

F. Glen Hemby
Dean of the Graduate School

EXAMINING COMMITTEE:

Date of Examination:

April 14, 1989